ELECTRICAL REVIEW

25th APRIL, 1952

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Mining Hazards

FIVE months ago attention was directed on this page to the difference between American and British ideas of enclosure for flameproofing electrical equipment installed in oil refineries. This disparity in practice is made disturbingly prominent by the report of the Deputy Chief Inspector of Mines on the circumstances attending the explosion which occurred at Eppleton Colliery, Durham, last July.

The coal seams there are not particularly gassy, but firedamp is a hazard in all of them. The method of ventilation seems to have been somewhat precarious, largely inherent in " brokens " working (retreating longwall faces) while the circumstances of pillar extraction at the time consequently made the locality difficult to ventilate constantly and adequately. But the disaster was not due to any excessive risk taken in unusually dangerous circumstances. As the conclusions of the report summarized on another page show, it was caused by electrically driven machinery which did not conform with the standard of safety generally accepted by all manufacturers of such equipment in this country. Proper maintenance is vital for ensuring safety, more particularly when equipment is employed near to the coal face, but safety can be assured only by the initial installation of soundly constructed apparatus. Neither of the two kinds of American machines involved satisfied this requirement. Indeed, maintenance difficulties appear to have increased considerably about nine months before the explosion. That fact was not a coincidence; in the inspector's opinion it resulted from the rougher use of the machines in pillar extraction work which began about that time. In contrast thereto, a British-made arcwall coal cutter, associated with the imported Joy loader and shuttle car—therefore subjected to equally rough treatment—was found to be in safe working order after the explosion. Furthermore, in addition to the risk of ignition by spark, a serious fire hazard has been revealed by six years' experience of the operation of these machines.

Disquieting as are the circumstances emphasized by this report, in this country's urgent need for more coal it would be mischievous to hamper trials of electrical machinery from abroad. The introduction experimentally into "safety-lamp" mines of plant not quite in line with standard British requirements should be permitted only with the special consent of the Chief Inspector of Mines and subject to whatever safeguards he may deem it necessary to impose.

LESSONS LEARNED

Two weeks ago we suggested that the Anglo-American Council on Productivity should make a survey of what American ideas had been adopted in British industries as the result of the visits of their "teams" to the United States. We are therefore gratified to receive from the Council the first two of a series of short reports of this kind. They relate to the steelfounding and drop-forging industries, which although not electrical are of interest to electrical manufacturers who are their customers. Considerable increases in production have resulted from improved methods. These have not all been American, but American practice has evidently provided much inspiration. We look forward to similar electrical reports.

ENGINEERING WAGES

Six months after receiving an increase of 11s a week in their wages, workers in the engineering industry are putting in a claim for a further rise. The claim was foreshadowed at a recent meeting of the Confederation of Shipbuilding and Engineering Unions when the subject was referred to a later conference of the executives of the thirty-eight affiliated unions. This conference took place last week when it was decided unanimously to press for a "substantial" increase. The actual amount is not to be disclosed until negotiations begin (probably in about a month's time); regard will then be paid to the state of the cost-of-living index. About three million people are involved in the claim. It is not easy to calculate the gross effect upon the engineering industries' costs but a rise of £1 a week for adult male workers with proportionate amounts for female and juvenile workers would probably add about £200 million a year.

"FRUSTRATED" EXPORTS

Australia's decision to curtail imports has placed many manufacturers in a difficult position, among them the refrigerator makers whose plight was referred to in our last issue. It will not be possible to find alternative markets for all "frustrated" exports and the Government does not favour their diversion to the home consumer. The *Manchester Guardian's* Melbourne correspondent says that Australian importers fear legal action to enforce contracts which they have entered into, although they seem to have been as much the victims of *force majeure* as their suppliers. In any event legal proceedings would mar trade relations, for everybody hopes that the present situation is merely a temporary one.

ANTI-ELECTRIC PROPAGANDA

To the chorus of anti-electric voices, which grows ever louder, the Chamber of Coal Traders adds its strident note. In evidence submitted to the Ridley Committee it says that the use of electricity for space heating, water heating and cooking should be discouraged. Electrical people should be grateful that "discouraged," not "banned," is the word used. We have noted in this solid-fuel propaganda the gradual progress made—first electric space heating was attacked, then water heating and now cooking. About three million domestic electric cookers are in use, we believe. It will take more than the coal merchants (who are not interested in the B.E.A.'s low-grade fuel requirements) to persuade the owners to abandon these cookers.

Shell Haven Oil Refinery

Another Step Towards Making Britain Self-Sufficient

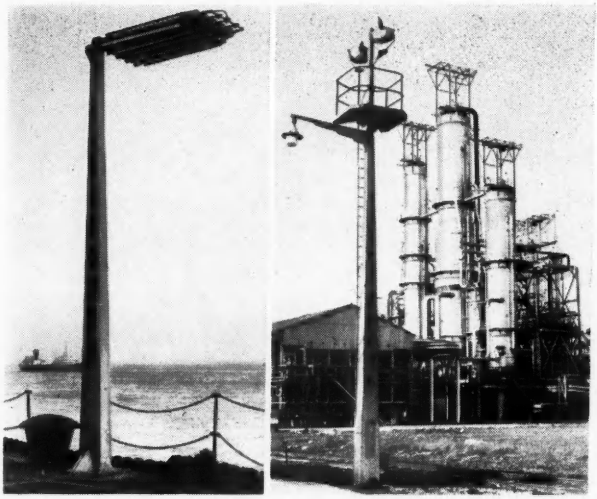
WITH the development of the new Shell Haven refinery on the Thames Estuary the "Shell" Refining and Marketing Co., Ltd., has, with its two other main refineries at Stanlow, Cheshire, and Heysham, Lancs, facilities for manufacturing over 8½ million tons of oil products a year—a productive capacity greater than that of any other refinery operator in the country. The starting up of the new plant also marks the completion of a further stage in the programme of making the United Kingdom self-sufficient in the refining of crude oil, which until the last war was undertaken mainly at the source of production.

Somewhat surprisingly, the name Shell Haven can, with slightly different spelling, be traced back for many centuries and it was purely by chance that such an appropriately named situation was selected for the refinery. A small (by modern standards) refinery was established there about twenty-five years ago for the manufacture of bitumen and petroleum-based solvents. This has now become known as Shell Haven East to distinguish it from the new enterprise, Shell Haven West, which is separated from it by a tank farm owned by the London & Thames Haven Oil Wharves, Ltd., with whom the company has an agreement for handling incoming crude oil, plant feed service, blending and storage of finished products.

The first unit of the new refinery, brought into operation just over a year ago, was a crude oil distillation plant designed to process about 6,000 tons per day of crude oil imported from Middle East sources. Soon afterwards, the inauguration of a doctor treater plant provided facilities for the treatment of 1,300 tons per day of straight run gasoline (petrol) from the distillation unit. The first stage of the refinery programme also provided for the installation of facilities for tetra-ethyl-lead blending of gasoline to the desired octane quality.

Subsequently additional refining plant has been installed including a reforming unit processing about 1,200 tons per day of naphtha or light gas oil. The final item in the present programme is a feed preparation plant to be put into commission shortly; it will produce 2,500 tons a day of bitumen stock for handling in the old refinery.

Above: **The crude oil distillation unit is seen in the centre, with the boiler house on the right**



Left: **One of the five-lamp flameproof fluorescent fittings used on the wharf.**
Right: **The crude oil distillation unit, together with road lighting standard and floodlights**

In general the electrical installation at the new refinery follows lines similar to those adopted at the other post-war Shell enterprises which we have described at Pernis, Rotterdam (29th December, 1950) and Stanlow (18th May, 1951). Especially notable features of the plant are the high degree of control by intercommunication and the almost complete elimination of steam for operating pumping units, practically all of which are electrically driven. One small departure from previous practice has been the placing of the remote controlled non-flameproof motor starters not in the open air protected by corrugated iron roofing but enclosed in brick buildings in "safe" areas adjacent to the plant served.

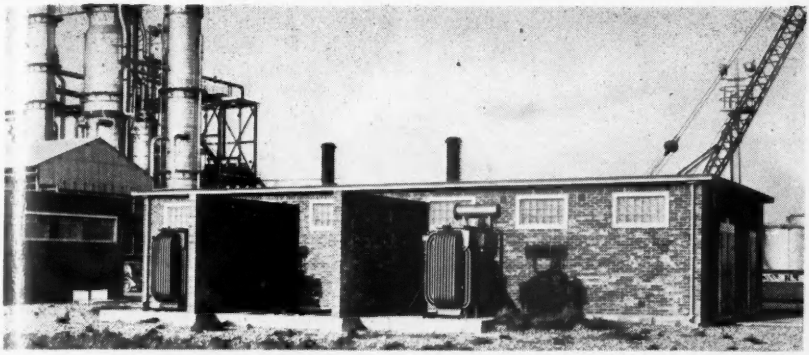
At present the old and new refineries between them have a maximum demand of just over 5 MW but this figure is expected to reach 6 MW this year as the new plant comes into full operation. Most of the load is accounted for by the 750 or so motors which, ranging in size from 1 to 500 h.p. (mainly of the high speed two pole type), are required for pumping the oil, its products or water (hot or cooling) used in the various processes. Altogether about 10,000 h.p. of motors (nearly all of Lancashire Dynamo & Crypto manufacture have been connected.

All motors, even the largest, are arranged for direct-to-line starting, up to 200 h.p. on 415 V and above that size on 6·6 kV. In danger areas M. & C. Switchgear flameproof push-buttons with associated ammeters have been fitted adjacent to the motors with the starter units grouped in a "safe" area nearby. In the case of the 6·6 kV motors Yorkshire Switchgear circuit breakers are used as contactor starters. M. & C. Switchgear contactor starters are used for the l.v. motors. Switchgear which has to be installed in danger areas is of either Walsall or Simplex manufacture.

In the crude oil distillation unit approximately 4,000 h.p. of motors have been connected, in sizes from 2 h.p. to 400 h.p., to drive the various Pulsometer pumping units. Theoretically every pump is duplicated but so great have been the demands on the plant that, to enable output to be stepped up from 6,000 tons to as much as 10,500 tons per day, it is frequently necessary to employ both units instead of retaining one as a standby. Accordingly, with the added load for lighting (from Walsall flameproof pendant fittings incorporating 300 W lamps) and other auxiliaries, the maximum demand for the distillation unit approaches 2,500 kVA. The load requirements of the other major units, also mainly for pumping, are approximately 500 kVA for the doctor treating plant, 600 kVA for the reforming unit and 500 kVA for the feed preparation plant.

The largest individual pumping units are to be found in the transfer pumphouse, where two 500 h.p. and two 250 h.p. L.D.C. motors drive the Stothert & Pitt pumps. The pumphouse is warmed by means of steam fan heaters.

To obtain the vast quantities of cooling

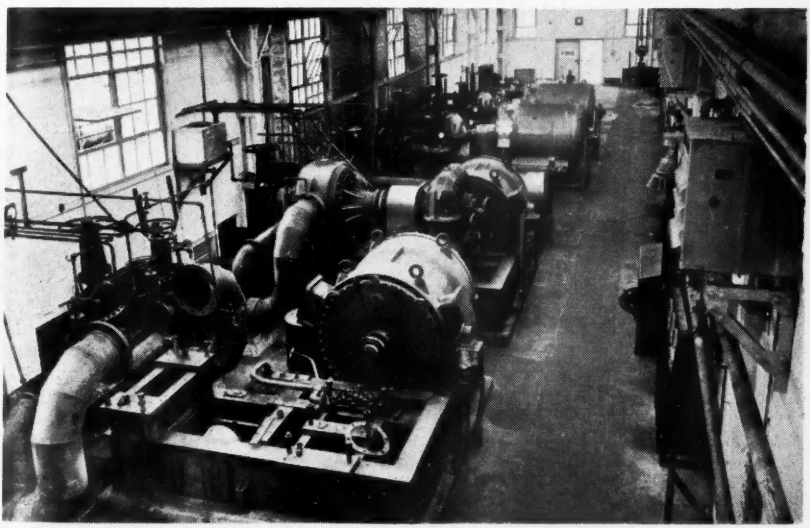


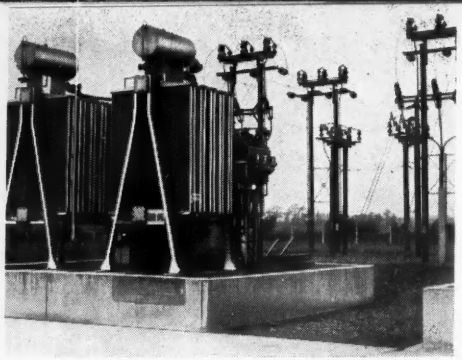
Substation No. 3 which provides 6·6 kV supplies to the crude oil distillation unit substation, the white oil and fuel oil pumphouse and the workshops and canteen substation, as well as 415 V supplies for the boiler plant, local power and lighting, etc.

water required, a 9ft diameter intake shaft has been sunk in the River Thames. From here the water is pumped to the process area offtakes through underground 8ft diameter concrete ducting and, after circulation through the various vessels, returns through a similar ducting to a large waste oil separator, designed to permit discharge of the uncontaminated water to the river. The main Metrovick steam turbine driven pump units, which are about 40ft below ground level, are capable of delivering up to 55,000 gall/min, diesel driven pumps of 2,500 gall/min capacity being used for fire fighting purposes. There is also one pressurizing pump, electrically driven, giving 500 gall/min.

The water supply is regulated by means of motorized valves, and rotary filters are incorporated in the system. The control

One of the transfer pumphouses ; the unit in the foreground has been dismantled for maintenance purposes





The 10 MVA 33/6·6 kV transformers through which supplies are received from Tilbury and Rayleigh

panel, which embodies Foxboro' flow and pressure meters, is wired in Pyrotenax cable and illuminated by totally enclosed fluorescent lamps. Holophane lighting reflectors are employed in the pumphouse itself.

At present three Babcock & Wilcox oil fired boilers of 110,000 lb/hr n.c.r. evaporative capacity supply steam to the various refinery plants, the pumphouse, the tank farms, shops, etc. The layout of the boiler plant incorporates facilities for the supply of compressed air required in operating the multitude of instruments and for general services, besides allowing for future installation of a duplicate set of boilers as further development of the refinery proceeds. In the boiler house, as elsewhere, full use is made of electrical auxiliary equipment and instruments.

Each refinery plant has its own control room, and in the main control room of the crude distillation unit—which is provided with a plenum heating system and is illuminated by laylights (G.E.C.) in the ceiling—are a series of panels comprising Foxboro' flow meters, pressure recorders, liquid level recorders, steam pressure indicators and recorders; Kent temperature recorders; Brown multi-position temperature indicators; and Marconi Instruments, Ltd., pH recorders.

To cater for the 2,000 men employed at the refinery an all-electric canteen has been equipped with a Peerless mixer, Hobart potato peeler, Asco slicer, " Creda " steaming and double baking ovens, Jackson cooker, griller, roasting oven and hotplate, William Green hotplates, John Rouse (Oldham) fish fryer, " Prestcold ", cold room and refrigerator, and Dawson " Deluge " dishwasher.

Throughout the refinery road lighting has been provided, utilizing Concrete Utility standards with Holophane lantern fittings and, where necessary, floodlights. On the wharf at the old refinery the illumination has been greatly improved by the recent installation of eleven B.T.H. 5-light 80 W flameproof fluorescent fittings to give a lighting intensity of 5–17 ft-candles. The tank farm is illuminated by 1,500 W B.T.H. long throw projection lamps and 400 W h.p.m.v. discharge fittings contactor operated from the pumphouses. Electrical Installations, Ltd., was responsible for this installation. A fully automatic navigational light in the Thames incorporates a fog signal.

Apart from other features mentioned many precautions against fire risk are taken. A fire alarm system is in direct connection with the refinery fire station and additional communication facilities are provided by Standard automatic telephones. As no matches or lighters are allowed in the refinery nearly 300 electric lighters (transformer operated at 25 V) have been provided at positions where smoking can safely be indulged in.

Bells and hooters indicating times of starting and finishing work are operated by means of an International Time Recorder system (as the processes are continuous, shifts work day and night).

The electricity supply to the refinery is received from the Eastern Electricity Board at 33 kV through alternative sources at Tilbury and Rayleigh. At present each of these supplies is taken separately to one of the two English Electric 10 MVA 33/6·6 kV transformers, but shortly the provision of further isolators will permit the taking of either supply through either transformer, thus giving virtually four separate sources of supply.

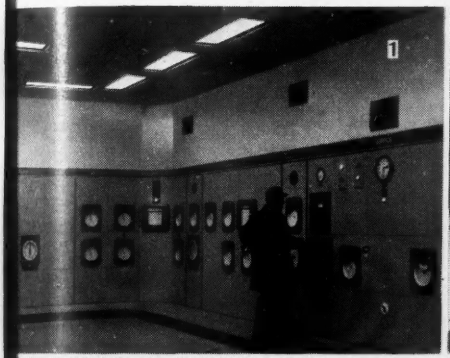
This practice of duplicating electricity supplies is continued throughout the whole of the refinery system except for a few of the less vital services. In the main substation (No. 1), as in all the secondary substations, the two sources of supply are kept completely separate and all the equipment is duplicated in separate, almost identical, halves of the building.

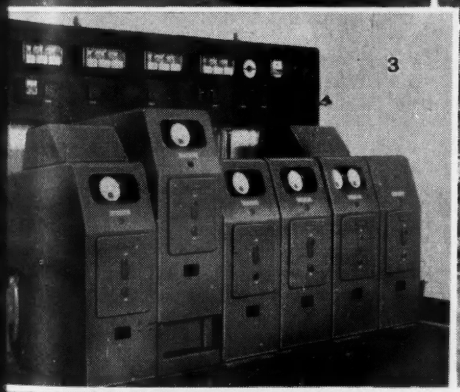
In direct touch with the B.E.A. control, this main substation, which is decorated in an attractive duck-egg blue colour scheme, provides supplies to both old and new refineries. In each of the two sections, which are separated by bus section switches

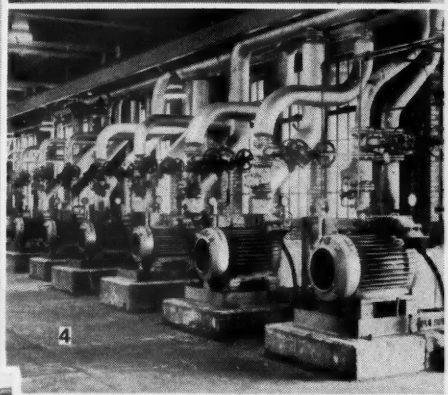
and a recording and metering panel, are Ryrolle switches of 250 MVA rupturing capacity controlling the incoming supply (1200 A), feeder oil circuit breakers to two substations (Nos. 3 and 4) in the new or West refinery (800 A), and one feeder oil circuit breaker to No. 2 substation in Shell Haven East (600 A). In addition the section taking the supply from Tilbury also houses an 800 A switch for the supply to the cooling water pumphouse. "Translay" protection with P.B.O. back-up is provided on all outgoing feeders. "Nife" batteries are provided for operating the solenoids of the switches.

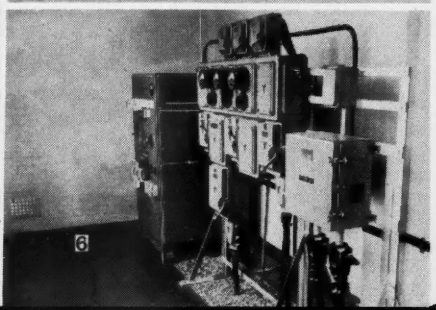
Heating of the substation is carried out by means of "Heatovens" convector heaters and "Spiraltube" fan heaters driven by Sturtevant motors controlled by Allen West starters. Teddington thermostats and

(1) A portion of the control room for the distillation unit. (2) Emergency lighting equipment, local switch-fuses and street lighting control at the main substation. (3) H.v. switchgear in No. 3 substation. (4) A row of pumps in the distillation unit. The backs of the push-button and ammeter panels are seen at the sides of the machines. (5) Portion of one half of the distillation switchhouse. (6) One of the two switchboards in the main substation

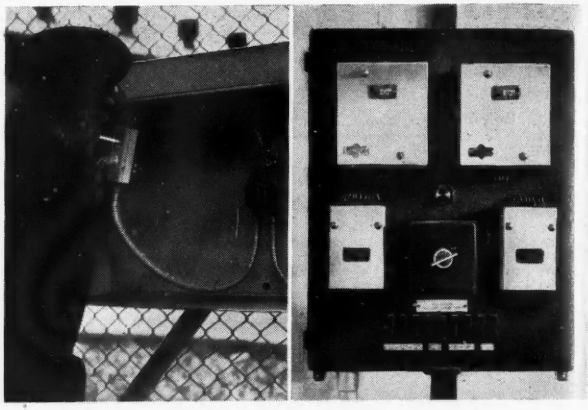








humidistats maintain a constant temperature. The main illumination is by means of G.E.C. fluorescent fittings, Holophane reflector fittings being used in conjunction with the "Keepalite" emergency system. Electro-Mechanical Manufacturing Co.'s "Y" switch fuse gear controls these circuits, and adjacent to it is a Contactor Switchgear switch fuse unit with Sangamo time switch for controlling the road lighting.



Left: **As no matches and lighters are allowed in the refinery, electric lighters have been provided at safe positions for smokers.** *Right:* **Should one source of supply fail, the bus section is automatically reclosed by a Londex relay, which also guards against simultaneous restoration of the original supply**

Of the two secondary substations fed from the main substation, No. 3 provides 6·6 kV supplies to the crude oil distillation unit substation, the white oil and fuel oil pumphouse substation (No. 6) and the workshops and canteen substation (No. 8), as well as 415 V supplies for the boiler plant, local power and lighting, etc. No. 4 substation gives h.v. supplies to the feed preparation unit switchroom, with l.v. supplies to the reformer, doctor treater, local power and lighting, etc.

Each half of the substations provides alternative supplies to the plant covered. Two Johnson & Phillips 1,000 kVA 6·6 kV/415 V transformers have been installed and Yorkshire Switchgear IVIO gear is employed throughout with rupturing capacity of 150 MVA in the case of the 6·6 kV supplies and 25 MVA for the 415 V supplies. Alklum equipment provides a 30 V d.c. supply for the tripping gear. "Translay" main feeder protection is again provided with overload and earth leakage back-up protection, and an Everett Edgcumbe earth leakage recorder is fitted on the l.v. side. Should one source of supply fail the bus section is automatically reclosed by means of a Londex relay unit which also guards against simultaneous restoration of the original supply by operating the appropriate isolator.

In the distillation substation duplicated Yorkshire 400 A switches, fitted with P. & B. Golds overload protection, control h.v. supplies to 250 h.p. and 400 h.p. motors and to 1,000 kVA transformers providing the l.v. supplies to the smaller motors and lighting, etc. An Electro-Mechanical non-flameproof switchboard controls the lighting of the whole of the distillation unit. In the distribution switchhouse situated above the substation the contactor switches, supplied by M. & C. Switchgear, Ltd., have yet again been duplicated in two separate banks served by separate feeders with a bus coupler between. The busbars in each bank have been split to segregate the main from the auxiliary plant.

Similar equipment to that used in the distillation substation has been installed in the other three substations in the new refinery. At No. 6 substation, which serves the white oil and fuel oil pumphouses, the 6·6 kV/415 V transformer has a capacity of 1,000 kVA. No. 7, which is fed from No. 6 and serves the crude oil pumphouse, and No. 8 (workshops and canteen) have 500 kVA and 1,000 kVA transformers respectively. All the transformers have Buchholz protection.

The main electrical contractors for the installation were Electrical Installations, Ltd., and T. Clarke & Co., Ltd., were responsible for the design of the lighting, instrumentation and installation on the distillation unit. The cable work was carried out under the supervision of British Insulated Callender's Cables, Ltd.

Boiler Drum Flaws

Ultrasonic Detection Practice

By C. J. RICHARDS

ONE non-destructive method of detecting flaws in riveted boiler drums is centred upon the application of ultrasonic waves. A pulse of energy, that is of logarithmically damped ultrasonic waves, is sent out by a transmitting quartz crystal into the shell plate of the drum, at a frequency of about 2½ Mc/s. This energy travels in the shell plate until it hits a discontinuity where part of the energy is reflected. The reflections are picked up by another crystal, acting as the receiver, then amplified and applied to the Y-plates of a cathode-ray tube. The X-plates of the latter receive a saw-tooth voltage from a conventional time base and the received signal manifests itself as a " blip " on the screen.

In the sketch of a standard probe, or wedge, upon which the quartz crystals are mounted (Fig. 1) the dotted lines represent a path along which the energy might travel favourably. The receiving and transmitting crystals may either be mounted on separate wedges, or upon one wedge; the latter, although interfering with clarity of energy reception, gives much less handling trouble when used in the confined space of a boiler drum.

Interpretation

A number of standard reflections from both the rivet holes and the back edge of the shell plate are under normal circumstances visible on the screen of the cathode-ray tube and they are suitably spaced (Fig. 2) depending upon the frequency and the amplitude of the sweep. Since the probes are relatively narrow, all " blips " are not visible at the same time, but for a given setting away from the butt strap their relative positions with respect to each other can be maintained on the screen. Cracks in the shell plate will, therefore, appear as " blips " superimposed upon this simple basic pattern. Through cracks, that is cracks bridging adjacent rivet holes, can be detected by the absence of parts of this pattern, since the energy is reflected before it reaches either the second row rivet hole or the back of the shell plate.

Thus, between the extremes of a sound plate and one that is disintegrating completely between rivet holes, lies the art of interpreting the many spurious patterns so invitingly presented to the operator. Definite rules cannot be applied, but a brief comment upon the apparent failure and weakness of this method of flaw detection as well as its obvious advantages may not be out of place.

" Perspex " probes now in general use are curved to make contact with the boiler shell plate and, in order to remain in

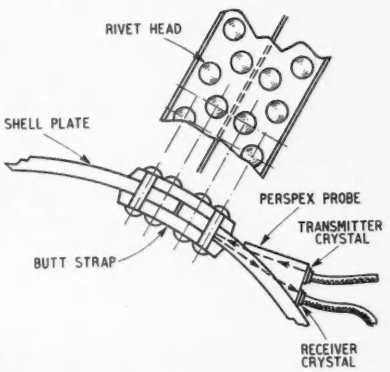


Fig. 1.—Standard crystal probe, or wedge, in position on boiler drum shell

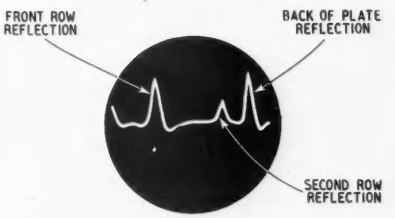


Fig. 2.—Reflection pattern on cathode-ray tube screen

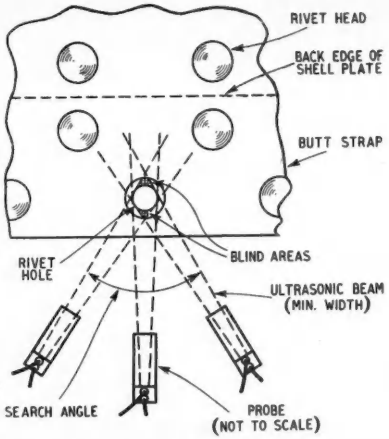


Fig. 3.—Beam angles of search probe

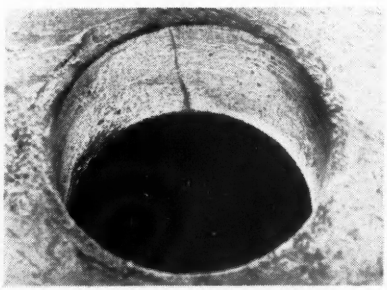


Fig. 4.—Small radial crack in shell plate of boiler drum

contact, the probe's search angle (Fig. 3) for each rivet hole is, therefore, limited. Since any given rivet hole can only be approached from one side of the butt strap, the limitation of the angular sweep of the ultrasonic beam results in the formation of blind areas in which small radial cracks cannot be detected. The photograph (Fig. 4) shows such a small radial crack in the shell plate of a boiler drum, the presence of which defied location on the screen of the cathode-ray tube. Cracks lying outside such blind areas are often difficult to recognize as such since they differ very little from spurious " blips " due to reflection from the underside of the butt strap. Experience has shown that these spurious " blips " prove less troublesome if detection is carried out from the outside of the boiler drum and many of such " blips " tend to disappear if the probes are withdrawn away from the butt strap, thus leaving the basic signal unimpaired. It cannot be said, however, that the ultrasonic method is itself infallible. Cases exist of which the records show that hairline cracks could not be located since their diameter was considerably smaller than the wavelength of the beam employed.

At this point other criteria affecting the interpretation of results should be mentioned. It must be remembered that the " blips," or signals, appearing on the screen of the cathode-ray tube continually vary, not only with the movement of the probes but also with the amount and consistency of the couplent, the hand pressure applied on the drum surface as well as the variations of the metallurgical structure of the metal.

Function of Couplent

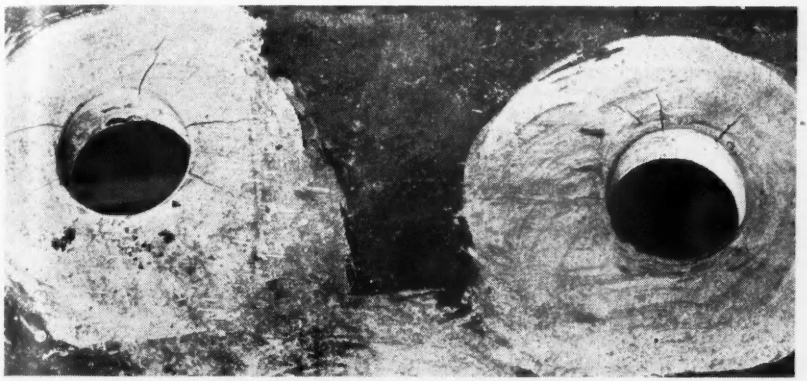
The couplent acting as a medium for improving the conductivity or transfer of energy to and from the metal consists of a mixture of starch and glycerine, or better still glycerine only. The advantages of a glycerine couplent lie in the fact that it is so much more easily washed off both from the operator and the boiler drum surface. The surface of the drum must be cleaned of all oxides and bright metal must be visible. This is a lengthy process and adds considerably to the time and manpower which must be expended before any investigations are made.

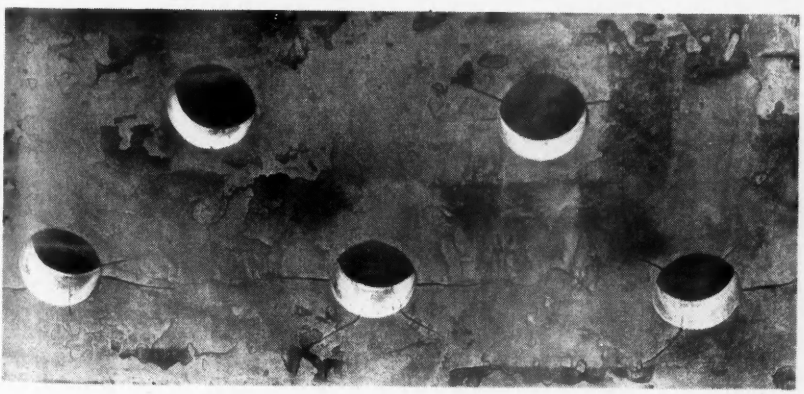
High costs prohibit the extensive use of mercury amalgams on very pitted surfaces and to a limited extent this is also true of plasticines. The great advantage and, therefore, perhaps the only reason why the ultrasonic method is finding a justifiable place in boiler drum flaw investigations is the fact that through cracks can be detected.

Thus it is hoped that an early warning of impending dangers may be given and it is for the purpose of finding such through cracks, rare though they may be, that the employment of detection teams and the purchase of costly equipment is fully justified. Signs of the possible existence of faults in the metal structure of the drum can, with practice, be detected and such areas of the shell plate are then marked as " doubtful." The removal of rivets in the immediate neighbourhood of such doubtful areas and the application of a magnetic

test will suffice to establish the condition of the plate. Here then, and with regard to through cracks only, does the ultrasonic method improve upon the 10 per cent renewal of rivets now advocated by insurance companies for boilers the service life of which exceeds 25 years. What must be the haphazard selection of rivets thus renewed can be reduced to a number of doubtful areas in which flaws are suspected. After the removal of rivets, holes in these areas are covered with a quick drying white paint, a magnetic flux is applied and a black magnetic fluid is liberally sprayed into the hole during the period of flux application. The location of one or more hairline cracks within the shell plate may then result (Figs. 5 and 6). The combination, therefore, of ultrasonic and magnetic methods can and does result in a comprehensive form of drum inspection.

The disturbing feature of boiler drums with cracked shell plates is that few outward signs necessarily present themselves, even in badly embrittled drums. It is, therefore, imperative that a close and continuous record of all leaks, shed rivet heads, etc., should be kept for each boiler drum by those responsible for the safe operation of the plant. Records of old boiler plant which show clearly the past fault histories of individual drums are often non-existent. On many occasions no reliable records over a period of years remain to tell of the water treatment that has, or should have, taken place. It is strongly advisable, in the light of present knowledge, to keep the sulphate/alkalinity ratios above 2·5 in all boiler





Figs. 5 and 6.—Cracks within shell plate rivet holes of a boiler drum

waters, although no conclusive evidence in fact exists to show that such ratios will always prevent embrittlement.

Fortunately boiler explosions are rare occurrences, but with the continually ageing plant that must be kept running often long after its normal life, the need for closer and more detailed inspection cannot be over-emphasized, for at all times vigilance is the price of safety.

The author is indebted to Mr. W. N. S. Clinch, M.I.E.E., controller, Eastern Division, British Electricity Authority, for permission to publish this article.

STARTING UP GENERATING PLANT

THE graphs below were shown during a lecture by Messrs. C. W. Priest and L. E. Brickwell to the Electrical Power Engineers' Association (London Technical Group). A report of this lecture appeared under the title of "Power Station Commissioning" on page 819 of the *Electrical Review* of 18th April.

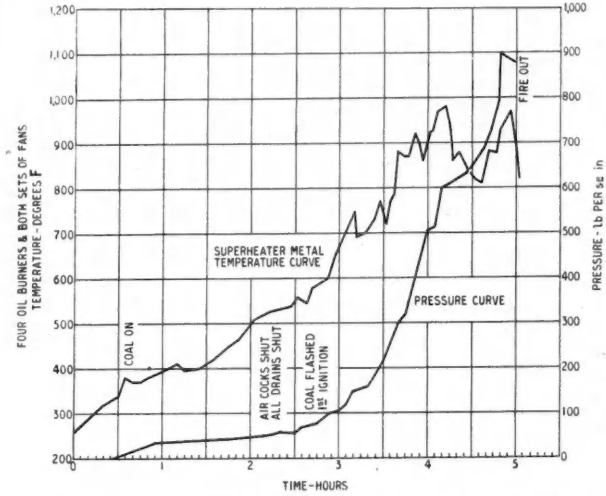

FOUR OIL BURNERS & BOTH SETS OF FANS
TEMPERATURE - DEGREES F
PRESSURE - lb PER sq in
SUPERHEATER METAL TEMPERATURE CURVE
PRESSURE CURVE
COAL ON
AIR COCKS SHUT ALL DRAINS SHUT
COAL FLASHED TO IGNITION
FIRE OUT
TIME - HOURS

Fig. 1—Raising boiler pressure with continuous firing

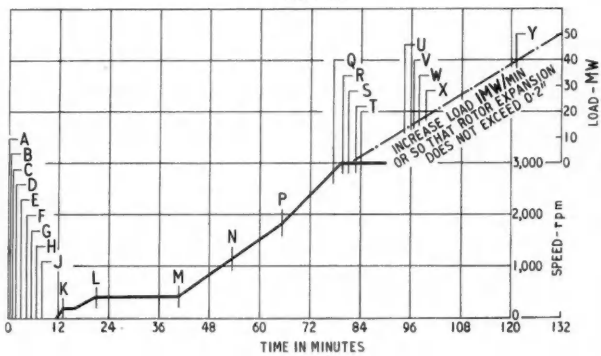


Fig. 2—Typical time schedule for cold start of a 50 MW set

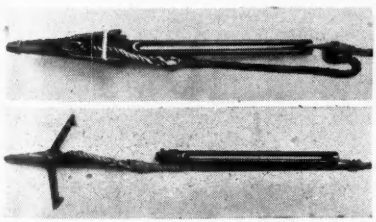
A—Prime circulating-water system.
B—Warm steam pipes.
C—Steam to manifold.
D—Auxiliary oil pump on.
E—Jacking pump on.
F—Barring gear on.
G—Flange warming steam to high- and intermediate-pressure cylinders.
H—Extra pump on; recirculator open.
J—Glands sealed; ejector on.
K—E.s.v. open; check speed; barring gear "thrown out."
L—Maintain speed at 400 r.p.m. at 25in vac. for 20 min or until h.p. and i.p. eccentricity <0·0005 in.
M—Increase speed 50 r.p.m./min; h.p. cylinder/rotor relative expansion 0·04in.
N—Circulating water on oil coolers, oil temperature = 95 to 105 deg F. Critical speed of rotor (1,500 r.p.m.) reached in 60 min.
P—Increase speed 150 r.p.m./min; change i.p. seals from steam to water; booster off.
Q—On governor contact.
R—Ventilating fan on; m.s.v. open.
S—Alternator synchronized.
T—Circulating water to air coolers; air temperature 105 deg F.
U—Flange warming steam off.
V—High-pressure heaters on.
W—Recirculators shut.
X—Heater drains pump on.
Y—Second ventilating fan on.

Electric Whaling

Quicker and More Humane Method

PAUCITY of precise data and of experimental conclusions has rendered it difficult to develop and apply a safe method of electric whaling. The Svend Foyn heavy harpoon was introduced in 1865 and has been little altered. Electric harpooning was first recorded in London in 1868 when a patent was granted, but nothing is known of the results of any experiments. There followed two Norwegian experiments, but the first promise of some success came in 1929 when Dr. Webber, a German engineer, succeeded in electrocuting four fin whales off the Norwegian coast.

Further experiments, including the reported electrocution of 250 whales in 1932–33 by the Sir James Clarke Ross fleet, were carried out in co-operation with Dr. Webber until 1945 when he destroyed all his papers before committing suicide. Post-war research and design have been continuously carried on for the last five years by the General Electric Co., Ltd., in close co-operation with the British United Whalers, Ltd., and in conjunction with Electrohval of Oslo.



"Detachable-leg" type harpoon (top) barbs folded as the harpoon enters the whale, and (bottom) opened out to prevent withdrawal of the head as the forerunner takes the strain. The title picture shows the forerunner snaking after the harpoon as it leaves the gun

Renewed impetus was given to this research upon the return from the Antarctic of Dr. Lillie in 1947, when he described explosive harpooning to members of the Universities Federation for Animal Welfare, which strongly advocated an investigation of possible more humane methods. Electrical killing seemed the most promising and United Whalers, Ltd., undertook the heavy cost of commissioning an experimental catcher to collect data during the 1948–49 Antarctic season.

The whale-catcher *Terje 2* was hurriedly equipped; heavy waterproof control gear was built, with a 250 V single-phase alternator; electric manilla forerunners (the lines to which the harpoons are attached) were made up, and the Konsberg Gun Co. of Norway sent an experienced technician to assist.

Major difficulties were revealed: first, the gear received an enormous buffeting when mounted in the bow, ploughing through high seas, and icing-up in snow and gales; the equipment demanded too much attention. Secondly, the harpoon was deflected in flight by the trailing of the manilla forerunner and by the heavy tubular sheathing on the leg of the standard harpoon, by which it was insulated against possible short-circuiting with the sea water. Moreover, many post-war gunners had adopted nylon forerunners, which suited Antarctic conditions better than manilla. In agreement with United Whalers, Ltd.,

the G.E.C. redesigned the master control panel to be housed in a miniature marine enclosure and mounted on the bridge for the convenience of the helmsman, or other appointed operator. In Norway the Elektrohval Co. and the Konsberg Gun Co. made a clean break with the adapted forms of Svend Foyn harpoon and produced an entirely fresh design. It is unencumbered with the heavy insulating tube and is now well known as the "detachable leg" type harpoon. The flow of current into the sea is prevented by withdrawing the shaft of the harpoon when the head and forerunner have become fast in the whale. Simultaneously the Pirelli-General Cable Works, in co-operation with British Ropes, Ltd., designed a flexible electrical conductor to be carried by the three-cordal rope and simulate the inherent characteristics of nylon, which can expand and contract by 40 to 45 per cent according to the pull on the forerunner.

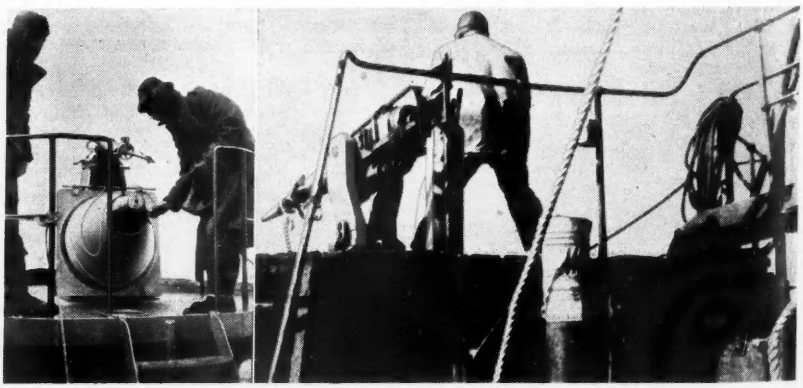
When considering the effects upon the whale itself it was learnt that the flow of current with any satisfactory shot produced immediate paralysis, the whale surfacing without struggle. The convulsion of the tail flukes (which can measure up to 24ft from tip to tip) acted as a brake upon the movement of the huge body and, turning over on its side, the whale was dead within a period of three minutes from the firing of the shot.

United Whalers, Ltd., next decided to commission a second catcher for the Antarctic season 1949–50 to form some idea of critical buoyancy, load figures, stresses, short-circuit conditions, time of flight of the harpoon and the effects of Antarctic sea conditions. Westley Richards & Co., Ltd., Birmingham, produced a spigot gun to fire a very lightweight harpoon while the Pirelli-General Cable Works had again to construct an ultra-light conductor of very high tensile strength, together with the necessary mechanical apparatus to feed it out at the higher operational velocity of the spigot gun.

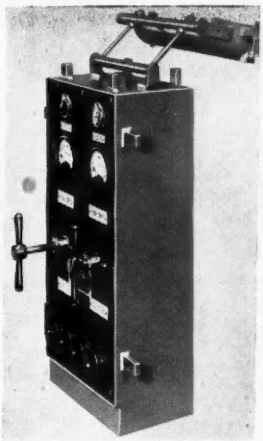
Sir Vyvyan Board, a director of United Whalers, Ltd., travelled 15,000 miles in the whale-catcher round the Antarctic continent to the Ross Sea area, accompanied throughout by Mr. Robert Marsden of the G.E.C. In addition, Mr. Dagfinn Bröther of the Elektrohval Co. with Mr. Venaas of the Konsberg Gun Factory carried out successful electric killing with the standard Konsberg gun. Westley Richards, Ltd., were represented in these trials by Mr. Roy Hill, who, having helped to build the experimental spigot gun, serviced it in the severe climatic conditions of the trials.

In the Antarctic the party naturally found operating conditions very difficult. There was an instance moreover of the snapping of the light harpoon, made of high-tensile steel, by the convulsive movement of the whale's dorsal muscles; the conductor was parted by the enormous strength of those muscles and the whale regained consciousness, ultimately swimming

Left: **The forerunner is coiled on a cone from which it will pay out with the least drag on the harpoon in flight.** *Right:* **Gunner handling the heavy Konsberg harpoon gun in the bow of a catcher**



away and taking part of the harpoon with it. In the end the expedition returned from the Antarctic with much vital information about the behaviour of various species of whale, the electric current required, time duration, and so on, and with a catch of 51 whales by the Konsberg gun. Attention was then directed to the stresses and strains imposed upon the mechanical whaling equipment. Wrights Ropes, Ltd., of Birmingham, experimented with manilla as an alternative to nylon, in conjunction with the Pirelli-General Cable Works which was faced with the problems of higher velocity, reduced weight and less coverage of yarn for the electrical conductor within the rope. Finally a lighter manilla forerunner was tried out with a newly-designed Westley Richards gun with satisfactory results. Instead of waiting for the Antarctic season United Whalers, Ltd., arranged for a trial expedition to the little island of Sao Thome on the equator off the African coast. A whale of the Sei species, weighing 50 tons, was quickly killed and, after various tests in which the mammal sank to approximately 300ft, it was safely retrieved and hauled in on a new type of forerunner, which the Pirelli-General Cable Works had produced on a new principle with a tensile strength of little more than half of that normally used. Further experiments are contemplated with an improved spigot gun, still using a lighter harpoon than normal.



Latest design of G.E.C. control panel for mounting on the bridge of the catcher

It may now be said that the whale can be killed without any undue pain and with less waste of whale-products. The average time for the shooting, killing and tying-up of a whale is considerably reduced with the electrical method; fewer electric harpoons are used and the consequent overall saving in time, materials and products will represent a substantial financial gain to the whaling industry.

GASIFICATION OF COAL

American Electro-Linking Method

A RECENT conference on the underground gasification of coal at Birmingham (U.S.A.), sponsored by the Alabama Power Co. and the U.S. Bureau of Mines, included representatives from Belgium, France, Germany and the United Kingdom.

One of the systems considered was the electro-linking method which has been tested on a small capacity scale at the Gorgas mine of the Alabama Power Co. An electric current is passed from one borehole to another, so raising the temperature of the coal sufficiently to cause combustion. Air is injected into one borehole and emerges with the gas from the other. In these tests continued passage of the electric current is said to have raised the temperature of the coal to the point at which distillation products were evolved.

As the burning seam face recedes the electrodes can be moved to a fresh pair of boreholes in order to fire another section of coal. The burning areas can thus be kept smaller and the gas-making "fluid" (air) can be more easily kept in contact with the burning coal. The experiments were carried out under land owned by the Power Co. and the particular seam was chosen because it was felt that the additional cover of fireclay and sandstone would maintain a tighter system, thus reducing seepage of air and gas.

The boreholes were spaced at 67ft centres

and made a straight line distance of 200ft. In each hole a 6in pipe casing extended from the surface to just below the coal bed. A water spray line and a thermocouple were installed in the annulus. The space between the casing and the hole was filled with cement grout and pressurized to seal cracks in surrounding strata. The coal bed was cored and then drilled with a diamond bit to allow a 4in stainless steel electrode to be seated 17in into the top portion of the bed. A 2in steel pipe containing a copper cable was fastened to the top of the electrode and brought to the surface to form the electrode stem. This circuit had a current carrying capacity equivalent to a 750,000 cir mil copper cable.

The electrode stem was insulated from the borehole casing by a 3in " ID transite " pipe extending from the top of the electrode to the surface. The input to the electrodes was delivered from a 500 kVA auto-transformer, tapped for varying voltage in steps of 100 V. This equipment was used by the Sinclair Coal Co. and the Missouri School of Mines in their experiments with electro-linking at Hume, Mo., and it was made available to the Alabama Power Co. in co-operative agreement.

The duration of current flow seems to have ranged from 0·5 to 17·5 hours, the voltage from 1,800 to 2,520 V and the current from 70 to 480 A. About 7,500 kWh appears to have been required to reduce the resistance between a pair of boreholes from 32 ohms to 2·7 ohms. Another pair of boreholes required 5,000 kWh to reduce the resistance from 44 ohms to 6·5 ohms. The power factor of the circuit varied between 95 and 100 per cent during this phase of the work. The tests indicated that over a period of time a path of high temperature carbonaceous matter permeable to air could be made ready between the boreholes for subsequent gas making.

During a 44-day period air injection between various pairs of boreholes varied from 95 to 365 cu ft/min at pressures of from 32 up to 100 lb/sq in. The calorific value of the effluent gas averaged 186 B.Th.U./cu ft and generally varied between 80 and 300 B.Th.U./cu ft, the higher value being generally due to methane from products of coal distillation. However, during one 132-hour period the carbon monoxide content averaged 13·2 per cent, indicating that gasification was taking place, but during this period the volume of effluent gas was small and a large fraction of the air pumped underground was not accounted for in the effluent gas.

The experiment is said to have indicated that (1) leaks in the ground strata can be reduced by firing coal seams at greater depths; (2) a large volume of air forced into the burning coal will yield a richer gas at a higher temperature; (3) greater air velocity, or preheating the intake air, will enrich the gas; and (4) the shale rock will fuse and melt to maintain sufficient strength to hold up the overburden to prevent cave-in.

The prime interest of the Bureau of Mines is in gas synthesis while that of the Power Co. is in obtaining gas to burn in boilers of steam power stations.

STREET LIGHTING NOTES

SANDWICH Council has approved a scheme for electric lighting estimated to cost £3,900, together with an extension to the junction of the Deal–Dover road costing a further £245. Proposals for lighting the Ramsgate road depend upon the provision of a continuous electric main along the road. Conversion of the existing gas lighting is to start in the main roads of the town and the whole scheme is expected to be completed by 1960.

At the meeting of SKIPTON R.D.C. surprise was expressed at the request of the Yorkshire Electricity Board for a contribution of £1,673 towards the cost of the conversion of street lighting at Sutton to electricity. It was pointed out that twelve months ago the figure quoted was £750. The Board attributed the increase to rises in the cost of labour and materials. A sub-committee was appointed to consider the matter.

FILEY Council plans to change over to electric street lighting and is seeking Government approval for the installation of 294 electric lamps at an estimated cost of £12,000.

ALDERSHOT Corporation has approved a scheme estimated to cost £2,000 for the provision of sodium lighting at Church Lane East.

BLYTH Corporation is recommended to approve the first stage of a street lighting scheme at an estimated cost of £5,600.

Tenders are being obtained by TRIMDON (Durham) Parish Council for the supply and installation of 27 mercury vapour discharge lamps on the central housing estate.

EASINGTON-WITH-THORPE Parish Council has adopted a £2,900 plan for improving the street lighting at Holme Hill and in the north, south and east sides of the Colliery Ward.

VIEWS on the NEWS

By REFLECTOR

THE recent case in which an injunction was made against the British Electricity Authority and others restraining them from polluting the Derwent has led a correspondent to the *Derby Evening Telegraph* to suggest that the water discharged into the river was sufficient to provide two baths a day for each inhabitant of Derby and district and the whole of the domestic hot-water requirements. Such a solution of two problems seems to a layman too obvious to be disputed but Mr. L. F. Jeffrey, the controller of the B.E.A. East Midlands Division, has had to explain why it cannot be adopted. Not only is the supply irregular and the heat of the "low-grade" variety, but the combination of power generation and district heating (as suggested) is not generally economical. Reference was made by the correspondent to the Pimlico (London) district heating scheme. Mr. Jeffrey points out that this is an experiment in circumstances which do not apply to the Derby case.

* * *

A detailed account published in Danish of the development of boiling plates during the last thirty years, including graphical comparison of the performances of normal and low-voltage types with descriptions of temperature regulating methods, indicates that efforts throughout have been to increase loading and improve efficiency. Of more personal interest is the confirmation this survey affords of my belief that the use of unsuitable utensils not only increases the consumption of energy for the same cooking operation, but also shortens the useful service life of the heating element.

* * *

A local paper records the formation of the Bournemouth and Poole Gas and Electricity Consumers' Association with the object of pressing for an amendment of the tariff system. This is a form of gas-electric co-operation likely to be irritating to both Gas and Electricity Boards, but that is not what worries me. In both industries quite elaborate "machinery," in the form of Consultative Councils, has been set up to put the consumers' points of view and safeguard their interests. Why should it be necessary to form further protective organizations? Is it because Consultative Councils are regarded as mere "yes-men" to the Boards which they are supposed to watch? If so this is perhaps unfair. The truth is that the Councils obtain a fuller appreciation than the general public of the Boards' difficulties and to understand all is to forgive all.

* * *

Replying to protests from the colliery village of Newtongrange (Midlothian) over delay in providing electricity, Mr. V. P. Mackay gave a promise of an early supply now that a line had been run from Portobello power station. He said that this would supplant obsolescent generators at the power stations of local collieries and from the details which he gave of this plant "obsolescent" would seem to be a just epithet. One 1,000 kW set had been installed in 1911; a 4,000 kW set, installed in 1927, had been built in 1912. The latter set had been used in a pumping station on the Seine. Its transfer to England must have been a smart piece of work on the part of the French.

* * *

In a lecture on indoor plants recently Mr. H. Clark, of Liverpool University, made some statements from which some sort of moral may possibly be drawn. I quote the following from the *Liverpool Evening Express*:—

> "Cut flowers in the home really became popular with the advent of electricity. Cut flowers, he said, do not like gas fires or any leakage of gas, and instanced carnations, which, he said, 'curled up and went to sleep' in proximity to a gas fire. It was due, he said, to watching the effects of gas on carnations that gave the first clue to the problem of anæsthetics."

PERSONAL and SOCIAL

News of Men and Women of the Industry

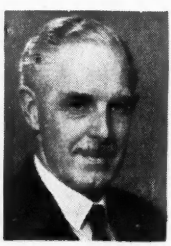
IT is announced that **Mr. James Oldroyd,** T.D., M.A. (Cantab.), A.C.I.S., has been appointed secretary of the British Electrical and Allied Manufacturers' Association in succession to the Hon. J. R. Rea, M.A., who was secretary for thirteen years.

Mr. W. F. Randall, B.Sc., A.R.S.M., M.I.E.E., F.I.M., a director of the Telegraph Construction & Maintenance Co., Ltd., will, at the invitation of the British Iron and Steel Research Association, act as chairman of the newly formed Conjoint Committee of B.I.S.R.A. and the Electrical Research Association on Electrical Sheet.

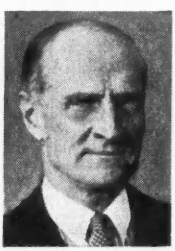
Mr. H. Lythgoe Reddyhough, M.I.E.E., M.Inst.F., consulting engineer to the Gourepore Electric Supply Co., Ltd., in London, and a director of the Kalgoorlie Electric Power & Lighting Corporation, Ltd., and the Electric Supply Corporation (Overseas), Ltd., will be proceeding on a world tour at the end of the current month on behalf of the various undertakings with which he is connected. His tour will embrace Pakistan, India, Malaya, Thailand, Indonesia, Hong Kong, Australia, Japan and Canada.

Dr. Percy Dunsheath, C.B.E., M.A., M.I.C.E., M.I.E.E., has been appointed president of the British Electrical Development Association for 1952-53 in succession to **Lord Citrine,** P.C., K.B.E., Companion I.E.E., chairman, British Electricity Authority, who has held the office for four years. **Mr. H. Nimmo,** M.I.C.E., M.I.E.E., M.I.Mech.E. (chairman of the Southern Electricity Board), has been elected chairman of the Council in succession to **Mr. C. T. Melling,** M.Sc., M.I.E.E., M.I.Mech.E. (chairman of the Eastern Electricity Board), and **Dame Caroline Haslett,** D.B.E., Companion I.E.E., director of the Electrical Association for Women, a vice-president of E.D.A., has been elected vice-chairman of the Council.

Dr P. Dunsheath



Mr. H. Nimmo



Dame Caroline Haslett

Mr. R. M. Grant, B.Sc., M.I.E.E., who joined the British Thomson-Houston Co., Ltd., in 1929, has been appointed assistant manager of the Plant Sales Department, Rugby. Mr. Grant was born at Stornoway and graduated at Glasgow University, obtaining honours in electrical engineering. After completing a three-year student apprenticeship course with the B.T.H. Co., Rugby, he had four years' experience in the Construction Department (London District) and joined the Plant Sales Department (Rugby) in 1936 as rectifier specialist. Subsequently he handled contracts for rotating machines for various applications, and in 1946 became the first leader of the Hydro-Electric Section. He has contributed a number of technical articles to the Press and has presented papers to various technical societies both in Britain and overseas.

Mr. R. M. Grant

Senor Dante Tartaglia, technical director of Sodre (the official Uruguayan broadcasting service), is spending two months in the United Kingdom under the British Council's bursary scheme to study British television services and equipment. The Sodre organization, which is subsidizing the visit, is planning to establish a television service. He spent the first month studying the B.B.C. television service, and he is at present visiting manufacturers of television equipment under arrangements made by

the Radio Industry Council. He will attend the Television Convention which the Institution of Electrical Engineers is holding in London from 28th April to 3rd May. Senor Tartaglia has represented Uruguay at a number of international conferences on telecommunication. He is a professor at the Technical University of Uruguay, and a past-president of the Institute of Radio Technicians of Uruguay.

Mr. G. S. Causon and **Mr. A. E. Nicol,** who have been in the employ, in various positions, of the Hackbridge & Hewittic Electric Co., Ltd., for nearly twenty-five years, have been appointed directors of the company.

At the annual general meeting of the Norwich Centre of the Institute of Industrial Administration, **Mr. W. G. Weston,** A.C.I.S., M.I.I.A., the Sub-Area secretarial officer of the Norfolk Sub-Area, Eastern Electricity Board, was elected chairman of the Centre. Mr. Weston was hon. secretary of the Centre from the time of its formation in 1947 until his election as vice-chairman last year.

Mr. L. S. Hargreaves, chairman and managing director of Aerialite, Ltd., has recently returned from a business tour of South Africa. During his visit he made final arrangements for the floatation of Aycliffe Industries, Ltd., a subsidiary of Aerialite, Ltd., as a public company.

Parnall (Yate), Ltd., announce that **Mr. F. Johnson** has been appointed home sales manager. He was formerly sales executive to a subsidiary in the Parnall group and joined the parent company as provincial sales manager in 1949.

Major-General L. B. Nicholls, O.B.E., C.B.E., chairman of Cable & Wireless, Ltd., has left this country for a tour of inspection of the company's telegraph stations at Tripoli, Benghazi, Malta and Cyprus. He will spend a week at Nicosia for discussions with the Governor on the internal telegraph system of Cyprus.

Winner of a bursary for the design of a domestic electrical appliance, one of several sections in a competition organized by the Industrial Art Bursaries Board for the Council of the Royal Society of Arts, is **Mr. D. H. Powell,** a 19-year-old designer on the staff of E. K. Cole, Ltd. His design, which won for him £150 and an associate membership of the Royal Society of Arts, is for an electric hot-plate which the jury considered would be economical in production and in use.

Two more awards for 25 years' service have been made at the Willesden Works of **Lancashire Dynamo & Crypto (Mfg.), Ltd.,** bringing the number of recipients at that works to 66 and raising the total in the company as a whole to over 300. The latest presentations were made to Mr. F. C. Peters, of the Progress Department, and Mr. C. Williams, foreman of the Fractional Motor Assembly Department, by Mr. D. C. Lorkin, joint managing director of L.D.C. in the presence of Mrs. Lorkin and Mr. F. H. Schroeder (sales director) and Mrs. Schroeder and before a gathering of over 700 people at the annual dance given by the directors on behalf of the Willesden Works at the Porchester Hall, Bayswater, on 4th April.

In our 11th April issue we reported the election of **Mr. Hector V. Slade,** M.B.E., T.D., A.M.I.Mech.E., as chairman of the Radio and Electronic Component Manufacturers' Federation. Mr. Slade, whose portrait we now reproduce, is deputy managing director of the Garrard Engineering & Manufacturing Co., Ltd.

Mr. H. V. Slade

Mr. E. G. Plucknett, director and joint general manager of the Tube Investments subsidiary, the Simplex Electric Co., Ltd., has flown to South Africa on a visit to its associate, Simplex Electric Co. (South Africa) (Pty.), Ltd. Mr. Plucknett, who will also be visiting the company's agents in South Africa, Rhodesia and East Africa, expects to be away about a month.

Mr. W. H. Williams, who recently retired after more than fifty years' service with the Rhyl electricity undertaking and the Merseyside and North Wales Electricity Board, has been presented with an inscribed wrist watch by the staff at the works.

On 18th April an informal gathering took place in the canteen of **Litholite Insulators & St. Albans Mouldings, Ltd.,** when presentations were made to all employees of the company who have completed twenty-five years' service. Each received a certificate and a cheque.

The 1951 Lamme gold medal of the American I.E.E. has been awarded to **Mr. A. E. Silvers,** retired consulting engineer, for his contribution to rural electrification by the design of a simplified farm type transformer combined with high voltage, long span and common neutral line construction.

Mr. E. S. Evans, general manager of Ekco-Ensign Electric, Ltd., left by air on 13th April for an extensive tour of Australia, New Zealand, Ceylon and India.

The Midlands Area Final of the **Electrical Industries National Golf Championship** has been arranged to take place at the Edgbaston Golf Club, Birmingham, on 20th August next. Qualifying cards (2s 6d each) are now obtainable from the hon. secretary, Mr. G.

Redmond, 99-100, Charlotte Street, Birmingham, 3. (Central 7809/0). There will be a number of valuable prizes including the Railing Cup and replica for the winner and the Jacob Cup and replica for the runner up.

Mr. J. Willis has been appointed lecturer in electrical engineering at the University of Manchester.

Mr. F. R. Scarrott, who has been with Ranton & Co., Ltd., for twenty-one years, has been appointed sales manager.

Mr. John R. Lovegrove has been appointed representative of the Britmac Electrical Co., Ltd., to take over the Midlands area which was previously covered by his father, Mr. C. S. Lovegrove, whose death is reported in our obituary section.

OBITUARY

Mr. James Reginald Hawkes, principal of J. R. Hawkes & Co., electrical contractors, Leicester, died on 13th April at the age of forty-three.

Mr. Frank Craven, who has died in hospital at Bradford at the age of sixty-nine, was proprietor of W. P. Holt & Co., Ltd., electrical contractors, Bradford, and had been chairman of the Bradford branch of the Electrical Contractors' Association.

Mr. Christopher S. Lovegrove, who represented the Britmac Electrical Co., Ltd., in the North of England and the Midlands for over forty years, died on 10th April following an operation.

Mr. R. B. Hague, founder and managing director of Hague & McKenzie, Ltd., has died at the age of sixty-nine.

Mr. J. N. Fulton.—The death is reported of Mr. J. Norman Fulton, O.B.E., head of J. Norman Fulton, Ltd., electrical engineers, Belfast. Mr. Fulton, who held a number of important agencies, specialized in refrigerating work.

Mr. Orlando G. R. Beere, A.M.I.Mech.E., A.M.I.P.E., director of the Selson Machine Tool Co., Ltd., for the past fifteen years, died on 7th April. Mr. Beere, who was in his 75th year, was well known throughout the machine tool industry.

WILLS

Mr. R. Halsall, F.S.A.A., a deputy secretary of the British Electricity Authority, who died on 9th November last, intestate, left £22,183 gross (£21,710 net).

Mr. H. L. McMichael, M.I.E.E., chairman and managing director of McMichael Radio, Ltd., who died on 17th November last, left £29,215 gross (£27,100 net).

Mr. J. L. Carr, M.Sc., M.I.E.E., technical and research engineer to the North Western Electricity Board, who died on 4th November last, left £9,351 gross (£9,278 net).

Mr. H. Coope, district manager in Cardiff for the Metropolitan-Vickers Electrical Co., Ltd., who died on 20th October, left £12 158 gross (£10,955 net).

Mr. Thomas Dixon, late of the Dictaphone Co., Ltd., who died on 2nd November, left £65,352 gross (£64,907 net).

COAL BOARD NETWORKS

Transfer to Electricity Board

A JOINT statement issued last week by representatives of the National Coal Board and the British Electricity Authority said it had been agreed as a matter of national policy that the low-voltage networks which passed to the various Divisions of the Coal Board upon nationalization are to be transferred to the Area Electricity Boards.

The statement was made after a private meeting at which representatives of the two Boards, Easington Rural District Council, ten parish councils and Mr. E. Shinwell, M.P., had discussed electricity supplies to many of the parishes in the Easington rural area (population 82,000) supplied by Coal Board networks. Complaints about the poor supplies had been raised at public meetings in the area.

More than 100 networks passed to the Divisional Coal Board and the number of consumers was approximately 42,000, said the statement. The majority of the networks would require overhaul, and it would be necessary to rewire a large number of houses (probably as many as 40,000) and other premises before the North Eastern Electricity Board would be able to connect them. It was expected that the work would be completed in four to five years.

Referring to Durham, the statement said that although in some instances electricity had been generated and distributed from collieries, in the main the networks were furnished with electricity purchased by the Divisional Coal Board from the North Eastern Electricity Board in conjunction with power supplied primarily for the collieries.

Although originally the capacity of the networks was capable of meeting the demands, consequent upon the general growth in the domestic consumption of electricity the systems had become seriously overloaded, resulting in low voltage in a large number of cases.

In addition to the networks in County Durham, the North Eastern Electricity Board was also responsible for supply in Northumberland and in parts of Yorkshire where networks had also to be transferred.

Electricity and Productivity

The Supervisor's Role

A LECTURE was given by Mr. C. T. Melling (chairman, Eastern Electricity Board) on "Electricity and Productivity" at a meeting in London on Tuesday of the Association of Supervising Electrical Engineers. Mr. Melling began by explaining the term "productivity." He said it was not merely the capacity to produce, but the making of the most effective use of equipment, material and labour. It was essential in raising the standard of living. He then surveyed the use of electricity in industry and indicated how small a proportion of total costs it was responsible for. He showed how good lighting assisted production and emphasized the important and advantageous part played by the electric motor in driving production machinery.

Mr. Melling said that there was now a much greater appreciation of the benefits in industry of mechanical handling, which, he mentioned, was a specialist branch of engineering and was to form the subject of an exhibition at Olympia in June.

Industrial Heating

The cleanliness and "flexibility" of industrial electric heating was next stressed and the lecturer gave examples of processes for which it was eminently suitable. He said that electrical engineers should always be on the look-out for possible applications of electric heat; so far some of the most striking had been initiated by non-electrical people, e.g., heating for pottery kilns.

Contributions made towards improved productivity by electric welding could be increased by a certain amount of re-design of parts made by other processes. Much advantage had been derived from magnetic and electrical methods of testing (non-destructive) and inspection.

The next section of the lecture showed how electrical applications had altered the layout of factories in such a way as to expedite and increase production. It was the duty of A.S.E.E. members to see whether electricity could help to get things moving faster. Examples were quoted of the way in which electricity could help to increase productivity by combining one process or machine with another.

Mr. Melling pointed out that while electricity was helpful in large-scale production it could also bring benefits to the craft industries by relieving the craftsman of much laborious work.

In conclusion Mr. Melling again emphasized the importance of the role of the supervising electrical engineer in seeing that electricity was used to the best advantage. He mentioned the work that the Electrical Development Association was doing to assist in this and gave credit to Mr. J. I. Bernard, chief technical officer of E.D.A., for his assistance in the preparation of the lecture.

Avoidance of Glare

HOW, as a result of recent research, it is now possible to prepare "tailor made" lighting installations, and so provide abundant light, yet which will be comfortable to the eyes, was explained on 21st April by Mr. W. Robinson, B.Sc.Tech., A.M.I.E.E., F.I.E.S., of the Electrical Development Association, speaking on "Glare and Discomfort," at the Lighting Service Bureau in London. His lecture was one of a series in the Bureau's lighting design course.

Electricity was able to provide all the light needed for a particular purpose, said Mr. Robinson, and the problem of providing this without complaints arising from eye discomfort through glare caused by unsuitable siting of the lamps or their number and size, had been solved by research carried out over a long period. Hundreds of tests were made, using a wide variety of different sizes and types of lamps, and the results had been tabulated and classified. The new technique was known as "brightness engineering," and it enabled a lighting installation to be planned in advance for any particular set of conditions, with the knowledge that when completed, the light would be adequate for the purpose for which it was intended, and yet comfortable to the eyes of the workers. The new technique also provided much more precise information to the lighting engineer, in that it enabled him to forecast the brightness or reflection value of walls and ceilings, which played an important part in lighting installations, particularly of the industrial type.

E.D.A. Annual Report

Electrification as a Means of Increasing Productivity

THE belief that the present position of industry could be greatly improved by the further use of electricity is emphasized by the Council of the British Electrical Development Association in its report for 1951 presented at the annual general meeting last Friday. The Council is confident that the Area Boards can contribute to increasing production through greater electrification. They are able to disseminate information on improved processes, techniques and machines; to advise on the choice of electrical plant; to introduce manufacturers and consultants who can deal with the highly specialized aspects of modern productive industry; and, in particular, to ensure that the best use is made of the restricted supplies of electricity at present available.

Study Books

Accordingly the Association has in hand the production of study books to assist in the training of industrial power engineers and to provide a ready source of reference in the field. In addition, a film dealing with material handling is being prepared. Three study books and film strips are in course of preparation dealing with material handling, industrial lighting and industrial heating.

Other subjects which are to be similarly dealt with include electric motor applications, instrumentation, h.f. industrial heating, industrial electric trucks, infra-red drying, welding, etc. Several professional and trade bodies have already agreed to accept papers on various aspects of electricity and productivity, and discussions in trade groups and special courses in technical colleges are also being sponsored.

Turning to more general matters, the report says that the Association's activities included the issuing of more than 300 articles to the Press, and the insertion in national periodicals of advertisements designed to promote greater economy and efficiency in the use of electricity without creating additional demand. Representations were made to the Chancellor of the Exchequer with the object of securing a reduction of purchase tax on vacuum cleaners, washing machines and immersion heaters.

Fourteen new publications on a wide range of subjects were issued and ten were in course of preparation. Four new films in the educational series covered electrical terms, the history of lighting, water heater installation, and distribution. Other films in course of preparation have as their subjects electrical measuring instruments, alternating current, induction and capacity. The second part of the colour film " Boiling and Simmering," featuring Philip Harben, was completed. The Association participated in a large number of exhibitions and agricultural shows. As an addition to the original scheme for equipping domestic science colleges two further colleges were dealt with.

Testing-House Activities

During the year the Testing House issued fifty reports and twelve addenda, the latter covering modifications submitted by manufacturers as a result of criticisms contained in the original reports. Fourteen reports were prepared for the Canadian Standards Approval Division of the British Standards Institution in connection with the Canadian export scheme, and three reports were prepared at the request of manufacturers to assist them in their export work.

Technical problems investigated by the Domestic Installations and Appliances Committee included the consideration of pressure points of cabinet cookers on floor surfaces, boiling plate earth connections and methods of test, calibration of oven thermostats, and undue rise of temperature on the exterior of some cookers. A variety of general problems relating to the safety of electrical apparatus were submitted for adjudication to the E.D.A.–B.S.I. Advisory Committee on Electrical Appliances and Accessories.

Before the war it was generally assumed that when tramways were abandoned trolley-buses would succeed them. In point

of fact the post-war position appears to show that in nearly all cases motor-buses have been the successors. The Trolley-bus and Tramways Committee is most anxious to deal with the state of affairs revealed, by stopping the recession and at the same time building up once more a load which is considered fundamentally beneficial to the electricity supply industry by reason of its good load factor, and essential also from the standpoint of the national economy and the situation that might arise in the event of war. A brochure on the subject is being prepared.

Educational activities included a sales management conference, the annual E.D.A.–E.A.W. conference of electrical housecraft advisers, senior demonstrators and senior showroom assistants, and a public speaking competition. Enrolments during the autumn for the salesmanship course totalled 396. Requests from schools for information and various services numbered 356.

B.E.A.M.A. in 1951-52

Review of Widespread Activities

As usual, the Council's report for the past year presented at yesterday's annual meeting of the British Electrical & Allied Manufacturers' Association covers a very wide field in an interesting manner. This year marks the Association's jubilee and a very brief history forms a preface to the report; in this such "high lights" as the inauguration of the World Power Conference, the publication of the B.E.A.M.A. Catalogue and the establishment of a Chair of Electrical Engineering in Cambridge University are referred to.

At the end of the year the membership of the Association was 380. The report says that its jubilee year was marked by a record figure for electrical exports which rose by 20 per cent to over £189 million. A substantial section of the report deals with exports. It is estimated that exports of the world's leading electrical manufacturing countries were valued at £625 million in 1951—more than eight times the average annual value in the 1930s. Whereas before the war the British and American share of world electrical trade was under a half, last year it was 62 per cent—this being divided roughly equally between the two countries.

Thus, with the other engineering industries, the electrical industry contributed substantially to the country's balance of payments. A notable feature was an increase of £10½ million in the value of domestic appliance exports. About three-fifths of the total electrical exports went to Commonwealth countries, the greatest actual expansion occurring in the case of Canada. It is expected that as a result of orders now in hand an even better showing will be made.

Some particulars are given of the substantial help afforded to members by the Export Department in the way of information and statistics, consultation with Government Departments, the study of trade agreements and the assistance of trade missions, the operation of overseas committees, and collaboration with other organizations.

Reference is made to the resurgence of German competition, aided by the Germans' ability to quote shorter delivery periods and to competition from Japan which is said to have lessened during the past year. Japanese prices are generally no lower than the British. Japan has concentrated all her influence on India and Pakistan with the result that British electrical manufacturers have lost substantial business in these territories.

At home, as an outcome of planning and reorganization by generating plant makers, more plant was commissioned last year by the British Electricity Authority and Area Boards than ever before and repair periods were shortened. It is emphasized that the continued shortage of plant is due not to the manufacturers' inability to supply it but to capital restrictions imposed on the B.E.A. and Boards.

Shortages of materials have had most disturbing effects upon the electrical manufacturers' drive for greater productivity and

output and have imposed heavy work upon executives, purchasing officers, and on the Association's Materials Committee. Representations have been made to Ministers, but although the latter have recognized the electrical industry as one of basic importance it is clear that production may be adversely affected this year. An assessment is being made of the industry's steel position by an inquiry among members.

The lighter side of the industry has been injured by unreasonable restrictions, although it is impossible for manufacturers to extend, or even maintain, their hold on export markets without a reasonable level of home production.

Fuel and Power Policy

This leads to a reference to the setting up of the Ridley Committee on the use of fuel and power which has led to much debate and propaganda on the relative efficiencies of solid-fuel and power-using appliances. A panel was set up by the B.E.A.–B.E.A.M.A. Joint Committee to collate data on electrical appliances in relation to fuel efficiency and economy. In this connection a series of technical papers on domestic electric heating and cooking appliances is being presented at the British Electrical Power Convention this year.

The Council gives a warning about statements now circulating about the use of electric fires and other domestic appliances which ignore the fact that solid-fuel appliances, gasworks, locomotives, etc., consume high-grade coal whereas power stations use low-grade fuel. The comparative economies of occasional and continuous use are also ignored.

As regards research, the Council has warmly backed the appeal by the Electrical Research Association for increased subscriptions and a special capital contribution towards the cost of the new Leatherhead laboratories. A series of technical papers on research is being presented at the British Electrical Power Convention. Reference is also made in the report to the ways in which the Association is supporting and fostering the education and training of engineers, technologists and electricians.

Encouraged by the success of its booklet setting forth the case for the trolley-bus, the Trolley-Bus Committee has initiated plans for the dissemination of facts and information on the advantages of electricity in transport.

The second edition of the B.E.A.M.A. Catalogue, which it is hoped to distribute in the autumn, will have a circulation a third larger than before—16,000 copies. The classified buyers' guide will be in four languages this time.

Many other activities are touched upon in the report, among them being collaboration with the British Engineers' Association, codes of practice, the Heating Appliances (Fireguards) Bill, the Association of Short-Circuit Testing Authorities, electricity in the Festival of Britain, the British Industries Fair and other exhibitions, international contract practices and several other international matters, and the Advisory Committee on Electrical Appliances and Accessories.

The work of twelve Council Committees, twenty-three Sections and twenty-five Technical Committees is briefly reviewed in separate chapters of the report.

Contract Price Formulæ

THE British Electrical and Allied Manufacturers' Association has issued the April figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 12th April is deemed to be 134s. The " cost of material " figures are as follows:—

For electrical machinery and equipment: The Board of Trade index figure published on 12th April is 165·4.

For turbo-generating and allied plant: Materials used in mechanical engineering industries, 152·2; blast furnaces and iron and steel melting and rolling (40 and 41), 142·6; price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 18th April, 3s 7½d).

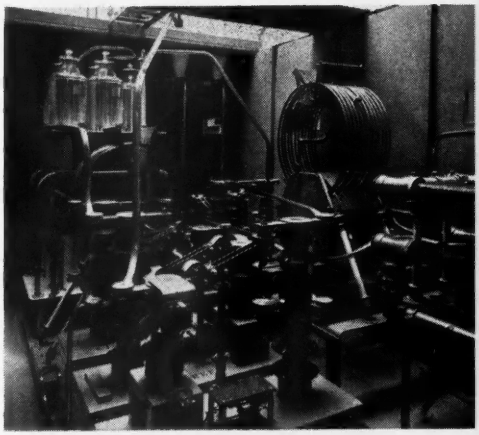
Outstanding contracts covered by the Board of Trade intermediate products index: The index figure for intermediate products (12th April) is 369·8.

BRITISH INDUSTRIES FAIR

Next week's *Electrical Review* will include a guide to the Electrical Section of the British Industries Fair, Castle Bromwich, with illustrated details of the electrical and allied exhibits in the Birmingham and London sections. (5th to 16th May.)

Unattended High-Power Transmitter

Automatic Monitoring Equipment for the Third Programme



In these combining circuits the output from the two halves of the transmitter are normally connected in parallel

THE new 150 kW Third Programme transmitter at Daventry, which came into service last year on 464 metres (*Electrical Review*, 13th April, 1951), has been working unattended since 13th January this year. This is a notable achievement since it is the first high-power transmitter to be operated by remote control.

The B.B.C. has been operating several low-power stations in this way for some time, but the unattended operation of high-power equipment is a much more difficult problem and its solution represents an important step towards easing the present-day shortage of skilled manpower. Normally at least two engineers per shift would be needed to operate a high-power broadcasting transmitter but by making possible the remote control of the station from another point, already and necessarily staffed, the trained technical staff normally in local attendance can be released for duties elsewhere. The remote control system being used has been jointly developed by B.B.C. engineers and by Marconi's Wireless Telegraph Co., Ltd., the manufacturers of the transmitter.

The new transmitter, which is capable of a full output of 200 kW, is operated with a maximum power of 150 kW to conform with the Copenhagen Plan. It was originally designed for remote operation over long distances and tests have proceeded while it has been in service, initially as a manned station. The transmitter is built as two identical units, the outputs of which are combined in a specially designed circuit so arranged that no transference of power takes place between the two sections; this circuit was designed and constructed by Marconi's to a B.B.C. specification.

The operation of applying the various power supplies to the transmitter is carried out automatically in the correct order and at the appropriate time intervals, by pressing a single "start" button at the remote control point. Operation of this button, which is in the main building, brings on the air blowers for cooling the valves, followed by the valve filaments and other supplies in their correct sequence until, with the application of the main h.v., both halves of the transmitter are working.

This sequence of events is initiated and controlled by a series of relays, a system of interlocks being incorporated to ensure that, not only are the supplies and services applied in the correct order, but any fault or failure of the supply will arrest the progress of the operation. As each operation is completed a lamp on an indicator panel in the transmitter building is illuminated. On manual operation this serves to show the engineers how far the chain is completed. It also serves as a useful guide in the location of faults when the station is on remote control; for example, if the transmitter shuts down and an engineer is sent to remedy the fault he will look at the indicator panel and see that, say, the auxiliary and main h.v. lamps are out. He will then check the auxiliary h.v. supply

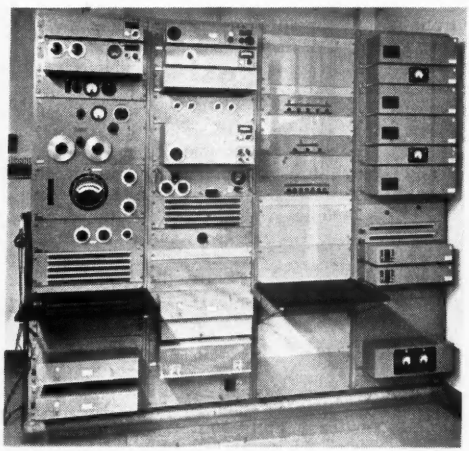
Control desk in the Third Programme transmitter building at Daventry and (right) the remote control panel and associated apparatus in the control room of the main building

and associated circuits since the indicator panel shows that the previous sections are in order.

When all the operations have been completed and the transmitter is on the air, indicator lamps at the remote points are illuminated. If these lamps should fail to light within approximately two minutes of pressing the " start " button the engineer at the remote point knows that some fault has developed which needs investigation.

Two specially designed automatic monitors developed by the Designs Department of the B.B.C. are arranged so that one continuously monitors each half of the transmitter. In the event of the automatic monitor on either half " noticing " a programme fault it automatically shuts down that half of the transmitter with which it is associated. At the same time, to prevent complete shut down of the station as a result of a comparatively minor fault, the monitor on the faulty unit removes the shut-down control from its counterpart on the healthy section, substituting an alarm circuit. The third automatic monitor checks the transmission from the aerial. To prevent the service being interrupted through a failure of the monitor itself, an ingenious arrangement is incorporated which enables it, on suspecting a programme fault, to ensure that its own circuits are functioning correctly before shutting down the transmitter.

Since the monitor operates by



Apparatus bays in the Third Programme transmitter building. The right-hand bay carries two automatic monitors, one associated with each half of the transmitter

comparing the programme as received with the programme as radiated it is essential that a momentary shut-down of the transmitter due, say, to the operation of the lightning protection gear, shall not be regarded as a programme fault. The automatic protection of the transmitter itself incorporates a number of devices which, on the occurrence of a fault, will remove the main h.v., wait a few seconds and then restore it. If the fault persists the main h.v. is again removed and restored. After the third attempt the transmitter automatically closes down and gives an alarm. During the three attempts to restore normal conditions the operation of the monitor is automatically suppressed. In the event of the breaks in programme being due to some other cause, the suppression would not take place and the monitor itself would close down the transmitter.

It seems fitting that this important development should be at Daventry with its long history as a B.B.C. transmitting station where much pioneering work in broadcast engineering has been done. It was from here, over 26 years ago, that the first high-power long-wave broadcasting transmitter in the world (5XX) commenced its transmissions.

Colliery Explosion

Causes of Accident at a Durham Mine

IN the report on the causes of the explosion which occurred at Eppleton Colliery, Durham, on 6th July, 1951, which is now available from H.M. Stationery Office (Cmd. 8503, price 2s 6d) Mr. R. Yates, Deputy Chief Inspector of Mines, gives a detailed account of the circumstances which attended the explosion.

He recalls that after the first inquest on the bodies of seven men who were killed outright the coroner recorded a verdict that they died " as the result of an explosion caused by some fault in the electrical equipment of the Joy loader." The jury added a rider that " the lack of supervision with regard to the maintenance and repair of these machines was most alarming and should be immediately rectified." At the second inquest on two men who subsequently died of their injuries the jury considered that there " had been some negligence in the maintenance of a pit machine and also a lack of care in the steps taken to discover the presence of gas."

The Eppleton Colliery is a large mine which has been extensively worked for 25 years. It is in Group " C " of No. 2 Area, Durham Division, of the National Coal Board. The mine is served by three coal winding shafts, two downcasts and one upcast. The seams are not particularly gassy, but firedamp is a hazard in all of them and safety lamps have been used throughout the mine for many years. No shots had been fired during the shift concerned; all the safety lamps, electric and flame, were examined at the Safety in Mines Research Establishment and passed as safe, with the exception of two electric cap lamps which had been damaged, but the inspector is satisfied that such damage was consequential and he dismisses safety lamps as a likely cause of ignition.

All the fixed electrical apparatus was found to be in a flameproof condition. Of the portable apparatus in use at the site at the time of the explosion, the only machinery at work was a Joy loader with a shuttle car at the face and an arcwall machine (running light) in the return airway. The inspector concludes that (*a*) the explosion had travelled all the working places and roads which were near to the face; (*b*) it was principally one of firedamp and there was little if any propagation by coal dust; (*c*) a falling barometer had probably brought about some encroachment of firedamp back in the goaf and some disturbance of a ventilation brattice (canvas sheet) was sufficient to enable firedamp to enter the area concerned where it was ignited at the master control box of the Joy loader and burned back into the goaf until it reached explosive range and there developed violence which swept from the goaf into the return airway.

The inspector is satisfied that this is the proper explanation of the igniting

source and behaviour of the explosion. This view is generally accepted by all parties and is supported by the fact that the cable adaptor box was found separated from the master control box of the Joy loader. The adaptor box had been mounted to the control box by means of a flange and spigot machined joint held by four fixing studs and a strengthening angle bracket, but none of the studs was found to be in position. Two had evidently been broken some time previously and the spigot joint had opened to create a crescent shaped gap in the side of the control unit.

The interior of the control box was in a very dirty condition and contained a quantity of coal dust and many small pieces of coal, which indicated that there had been open access to the inside switch contacts for a considerable period before the explosion. Tests carried out at the Safety in Mines Research Establishment, Buxton, showed that this gap readily passed flame in an inflammable mixture of methane and air when a test spark was made to simulate the break flash at the control switch contacts of the traction motor switches of the Joy loader.

The report goes on to describe and comment in some detail upon the operation of American mobile machinery, with particular respect to the arrangement of the cable entry into the master controller of these machines, as received from America. Cable adaptor boxes of different designs were fitted to enable the ordinary B.S. standard type of plug and socket to be employed. Although these additions had the effect of invalidating the U.S.A. " Permissible Certificate " they were agreed by H.M. Electrical Inspectors to be an improvement, provided the fittings were flameproof and of suitable mechanical strength and design.

The battery driven shuttle car used for transporting coal from the mechanical loader at the coal face to a discharging point outbye has a similar arrangement of cable entry and cable protection. This machine, therefore, is in the same category as the Joy loader but involves an added danger from the protected, but open-ventilated, battery containers designed to permit the safe dispersal of hydrogen gas discharge from the cells, thus constituting a further likely source of open sparking in the event of damage to the cells causing a short circuit.

The report includes an account of the condition in which these machines were found when examined after the explosion. It concludes with some general observations and recommendations.

Following the explosion the National Coal Board reverted to hand hewing and loading at the face of the " brokens " (retreating longwall faces) for the time being. It decided to avoid the use of shuttle cars in " brokens " in future and to accept a broad interpretation of General Regulation 132 until such time as amending electricity regulations come into force. Meanwhile it will adopt as a long-term policy the modification of the foreign apparatus now installed in its mines to British flameproof standards.

Demonstrators' Conference

THE North Western Electricity Board is holding a conference of electricity service centre senior demonstrators at Electricity Hall, Buxton, next week (from 27th to 30th April). The conference will open under the chairmanship of Sir Joseph Hallsworth (chairman of the Board), when Mr. N. H. Bridge, the Board's commercial development officer, will give a lecture on " Electricity's Rightful Place—the Answer to Popular Fallacies." On 28th April, Mr. W. G. Chilvers, installation engineer, will be chairman of the morning session and Miss Ena M. Eaves, women's education officer, E.D.A., will give a lecture on " Improving Demonstration Technique—Effective Speech and Action."

In the afternoon Mr. A. D. Pluck (consumers' engineer, No. 7 Sub-Area, Hazel Grove) will preside, and Mrs. M. A. Scallan, senior demonstrator, Jackson Electric Stove Co., Ltd., will speak on " A Model Cooker Selling Demonstration." This will be followed by a talk on " The Point of View of Housewife and Hostess," by Miss N. Kenyon, a member of the Board, with Mr. E. Binns (manager No. 3 Sub-Area, Oldham) presiding. At Tuesday morning's proceedings (chairman, Mr. N. H. Bridge) Miss Marguerite Patten, B.B.C. television cookery expert, will give a lecture on " Popularizing Cold Cookery." At the afternoon session (chairman, Mr. L. Loukes, consumers' engineer, No. 2 Sub-Area, Manchester) there will be three speakers—Miss J. Sharp, senior sub-area demonstrator, No. 3 Sub-Area, on " How I Organize My Work;" Miss M. Chadburn, senior sub-area demonstrator, No. 5 Sub-Area, Blackburn, on " Planning the Menus and Setting the Stage," and Miss D. M. Jones, senior district demonstrator, No. 2 Sub-Area, on " Home Service Calls." On Wednesday morning there will be a summing up, and replies to questions, under the chairmanship of Miss N. Kenyon.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Quo Vadis?

THE activities of electrical proving houses in the principal overseas countries have so influenced the manufacturing quality of the locally-produced accessory that British accessories are now regarded as being in a class apart. The reliability and the inherent soundness of their construction have become the envy of the world.

During the last thirty years, nearly every country, other than Britain, has experienced the now familiar pattern of events. First, the introduction of standard specifications—quite excellent in themselves; next, the demand for a proving authority to ensure compliance with these specifications; then, the "strengthening" of this step by the introduction of compulsion — invariably backed by the force of law; and, finally and inevitably, the dreary procedure of marking—each country using, of course, its own distinctive mark.

The result in each country has been precisely the same, however. Manufacturers, forced by law into a closely defined area of competition, have produced accessories which comply with the necessarily modest but specific electrical and mechanical tests. But since manufacturing technique cannot be so defined and controlled and competition is limited to price, the inherent quality of "approved" accessories has declined. To-day, the quality of the "approved" foreign-made accessory is well below that set by British-made accessories of the lowest grade.

If history teaches us anything, it certainly teaches us that mankind consistently ignores the lessons of history. With the experience of other countries to guide her, this country is apparently ready to take the first step along the same road. A British "Test House" has been established for the useful purpose of *disapproving* faulty apparatus; but enthusiasts are already visualizing this testing authority as a proving house with power to grant a distinctive approvals mark. We predict that when British electrical accessories lose their reputation for manufacturing quality, history will date the eclipse from the introduction of compulsory testing and marking.

The origin of the foregoing, now some years old, is unknown but it might well have been written *in memoriam* to that far-seeing and distinguished gentleman—the late Charles Rodgers, O.B.E.—whose tenacious opposition stilled the hue and cry of the "moderns" for the establishment of a British Proving House. The repetition of the article to-day is not out of place—but where can be found another Charles Rodgers?

Perhaps in an Australian State where some manufacturers in an attempt to ensure their future prestige have decided to abandon the State approvals scheme and rely solely on their individual trade marks because the inclusion of the "official mark" has become indicative of something just good enough—but not sufficiently good for the discerning trade buyers.

S. A. MILLINGTON.

King's Norton, Birmingham.

"Nationalized Inertia"

THE figures given in his letter in the *Electrical Review* of 11th April by "Frustrated" will not surprise any of us. It is abominable the wastage that goes on; under private enterprise there would soon be a reshuffle. Nobody now seems to trouble about anything or anybody. General assistants, office staff, just seem to get a car or van for the shortest of trips; I even know of transport being used to go 350 yards to dinner.

I have on many occasions had to wait half an hour to telephone our office. This state of affairs is constant and a serious matter when there are urgent calls in cases of faults.

On distribution I have had over 30 years' experience and I have seen more wastage in the last three years than in all the rest. The old experienced staff are not now consulted; the jobs are planned

and prepared by new staff with no practical knowledge or local experience, then handed over to us to carry out. I have never yet had a new extension to do that I have not had to alter, plus some that had gone too far to alter without showing somebody's blunders.

But what can be done about it? We cannot get to the responsible person who could alter this state of affairs; if we complain to the next number above us it gets no further. If there were meetings where all engineers could have a say in matters each month, instead of Local Advisory Committee meetings where nothing of importance can be discussed, something might be done. At present it is impossible for us to get to the chief engineer.

In conclusion I think, like my colleague, that Sub-Areas are expensive post offices.

"BAFFLED."

Employing the Elderly

TWO recent articles in your columns on the implications of the retiring age prompt me to bring to your notice the work of this Society in connection with the employment of the elderly worker.

Recently we conducted a survey among four hundred of our member firms to discover what was being done to facilitate the continued employment or re-employment of elderly people, and we are now issuing a pamphlet which is designed to help firms evolve a settled policy towards this increasingly numerous and potentially productive section of the community. To give you an idea of the lines on which our work is devolved I cannot do better than quote the last paragraph of the pamphlet:—

> "There is a great deal of research yet to be done into the problems of ageing before we are fully equipped to use our old people in the best national interest and to their personal advantage. Some progressive employers have in the past looked to the time when the normal retiring age might be reduced rather than increased, and surely no one would wish to deny that it is socially desirable for old age to be a pleasurable experience. But in the present-day conditions, a *working* old age appears to be a social and economic necessity; and employers already convinced of the value of good working conditions and welfare amenities should not need persuading to evolve and put into effect a policy that would make old age not only pleasurable but productive."

London, W.1.

THOMAS FASSAM,
Publications and Press Relations Officer,
Industrial Welfare Society.

Servomechanism Design

ON Tuesday last two papers of interest to those concerned with servomechanisms were presented at a London meeting of the I.E.E. Measurements Section. In the first Mr. E. E. Ward (Electrical Engineering Department, University of Birmingham) describes an analogue computer for use in the design of servo systems. He shows the principles on which analogue computers, accepting as input data the singularities of a rational function, may be designed to display together the Nyquist diagram, the Q-diagram and the step-function response of a linear servo system having one dominant closed loop. The paper includes full details of a simple model which has been built on these principles and gives some time and frequency functions computed by the model for certain patterns of singularities.

A certain type of hydraulic remote position controller contains two resonant systems in its sequence which are caused by resilience in the shaft connecting oil motor and mechanical load and by hydraulic resilience of the link between oil motor and oil pump. An idealized analysis of the system yields a sixth-order linear differential equation. When equalizing networks and possible non-linear effects are considered the solution of the system equation by mathematical methods over a large range of parameters becomes impracticable.

To ease the problem of computation an electronic simulator has been designed and this is described in the second paper which was prepared by Messrs. F. J. U. Ritson (King's College, Newcastle-upon-Tyne) and P. H. Hammond (formerly at King's College, now at the Telecommunications Research Establishment). The paper also includes an outline of the experimental work which has been carried out to check the performance of the simulator.

Commerce and Industry

E.D.A. Public Speaking Competition

Transport Conference Programme

TWO members of the Chorley District staff of the North Western Electricity Board won the women's and men's national finals of the E.D.A. public speaking competition, which were held at the Lighting Service Bureau, 2, Savoy Hill, London, on 17th April. This year's winners were Miss Muriel Eileen Shorrock, an assistant demonstrator at Chorley, who spoke on "What I Mean by Freedom of Choice," and Mr. M. Hall, a sales assistant at Chorley, who took as his subject, "Was the Festival of Britain Justified?" Of the ten women candidates, four spoke on "What I Mean by Freedom of Choice," three on "Should Housing Estates be All-Electric?" and three on "Was the Festival of Britain Justified?" Four of the men competitors spoke on "Was the Festival of Britain Justified?" and the other four on "What I Mean by Freedom of Choice."

The other winners were:—Women: second, Miss Mary J. Cumming (senior demonstrator, Clyde Sub-Area, Glasgow, South West Scotland Electricity Board); third, Miss Elizabeth Crowther (West Devon (Bideford) District of South Western Electricity Board). Men: second, Mr. A. J. Begbie (district commercial assistant, Totnes Service Centre, Torbay District, South Western Electricity Board); third, Mr. K. Prescott (assistant in the Statistics Department, Grimsby Sub-Area headquarters, Yorkshire Electricity Board). The adjudicators in the women's section were Mrs. Frank Forrest, member of Council, Electrical Association for Women, Lyme Regis, Mr. Frank Phillips, of the B.B.C., and Mr. J. W. Thomas, director of training, safety and welfare, British Electricity Authority. The judges of the men were Miss Vera Norvick, assistant secretary, Electrical Association for Women, Mr. Frank Phillips, and Mr. B. J. Ross, history master, City of London School. Mr. C. T. Melling, chairman of E.D.A., was the chairman at the women's session, and Mr. E. R. Wilkinson, past chairman of E.D.A., was chairman during the men's session.

Engineering Apprentices' Wages

An agreement on apprentices' wages has been reached between the Engineering and Allied Employers' National Federation and the Confederation of Shipbuilding and Engineering Unions. An increase of £1 a week was claimed; the agreement provides for increases ranging from 5s 6d for lads aged fifteen to 11s for those of twenty.

M.V. Apprentices

During the past half-century well over 10,000 apprentices and trainees have passed through the Trafford Park Works of the Metropolitan-Vickers Electrical Co., Ltd. In 1935 the company produced a register of these people, covering the period 1902–34, and a

Winners of the E.D.A. Public Speaking Competition

Left to right: Miss Mary J. Cumming, South West Scotland Electricity Board (second place), Miss Muriel Eileen Shorrock, North Western Electricity Board (shield winner) and Miss Elizabeth Crowther, South Western Electricity Board (third place), Mr. A. J. Begbie, South Western Electricity Board (second place), Mr. M. Hall, North Western Electricity Board (shield winner) and Mr. Kenneth Prescott, Yorkshire Electricity Board (third place)

second edition (1902–37) appeared in 1939. Now a further register has been compiled bringing the story up to the end of 1949.

It is a volume of 682 pages and of absorbing interest to anybody in the electrical industry for on every page well-known names can be observed. For each entry there is a brief biography and an indication of the ex-apprentice's present position. Most, of course, are still in the electrical or allied industries, but many have found their careers in quite other fields—farming, the churches, journalism, education, medicine and the law, for instance.

In addition to the alphabetical register there are geographical and chronological indices. There are also about 30 plates (some in colour) illustrating the company's works and products.

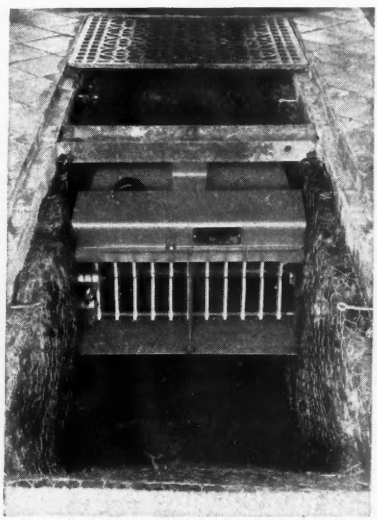
Church Heating

The adequate heating of historic buildings, keeping the apparatus hidden as far as possible, presents a number of problems. In the 13th century All Saints Church, Tilsworth, near Leighton Buzzard, these have been satisfactorily solved by means of an electrical installation carried out by the Eastern Electricity Board. The scheme, prepared by the General Electric Co., Ltd., consists of three 10 kW unit heaters fitted with low-speed fans having self-aligning and self-oiling bearings and 128ft of single way tubular heaters, giving a total load of 37·68 kW.

The unit heaters have been placed below gratings in ducts lined with "Bitulac" bonded fibre glass, supplied in semi-rigid slabs measuring 2ft by 3ft by 2in and covered with 1in mesh galvanized wire netting, as an insulator against the cold concrete in the initial stages and as an additional sound deadener to suppress the slight hum of the fans. The three units are arranged so that the convectional air streams are circulating in an easterly direction; by this means the forward unit helps to lift the temperature in the chancel and at the altar and the other units ensure that the maximum temperature is in the nave of the church where it is needed most.

There are 15 tubular heaters of varying lengths; some are fixed horizontally to check the cold down-draught from the windows and others have been fitted under the choir stalls. It has been found that generally ¾ hour pre-heating before a service is all that is required, though during a prolonged cold spell when the whole stone work and fabric have become chilled up to 2 hours is required. Consumption of electricity during the past winter has averaged 60 kWh for each service.

G.E.C. 10 kW heater in church nave, facing east



Insulation Manufacturers' Anniversary

Lindsay & Williams, Ltd., manufacturers of insulating materials for the electric cable industry, are celebrating their fortieth anniversary this month. Mr. H. R. Williams, chairman and governing director, founded the business in the latter part of 1911, in partnership with Mr. D. Lindsay, and the first supplies of material were dispatched in the following year. The concern became a limited company in 1915, Mr. Lindsay having in the meantime severed his connection with the company. The present premises at Openshaw Bridge Works, Manchester, were acquired in 1929, and an additional works in Grey Street, Openshaw, was opened in 1939.

During 1950 and 1951 Mr. Williams decided to reconstruct the company from an internal standpoint and relinquished the position of managing director, which he had held jointly with that of chairman from its inception. He appointed Mr. G. K. Moss as managing director. The present range of products includes almost every requirement of both the rubber and power cable industry, together with products for the electrical trade, etc.

Transport Conference

The annual conference of the Public Transport Association opens on Tuesday next at Torquay. The proceedings will extend over three days, and will be presided over by Mr. W. T. James, O.B.E., chairman of the Association. On the first day there will be a golf tournament followed, in the evening, by an informal reception at the Palace Hotel by the chairman and vice-chairmen. The delegates will be officially welcomed on the second day by Ald. E. G. Ely, the Mayor of Torquay, after which the annual general meeting will be held. Following this a paper on "The Effect of Present-Day Conditions on the Design and Operation of Public Service Vehicles," will

be read by Mr. G. W. Hayter, and in the evening the annual dinner will be held. At Thursday morning's session Mr. S. H. Edge will present a paper on "The Heating and Ventilation of Public Service Vehicles," and the conference will conclude with a civic reception and dance at the Town Hall. A number of tours have been arranged during the conference.

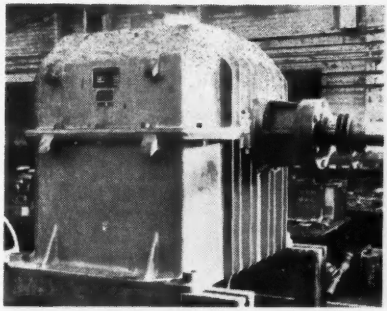
Building Maintenance Licences

The Ministry of Works draws attention to an extra facility now provided by annual maintenance licences. Arrangements can now be made for these licences to cover minor works of alteration consequent on the installation of new machinery and on the transfer of machinery from one factory to another, besides (as hitherto) on transfers in the same factory. Current licences will be amended on application to the Ministry's Regional Licensing Officers.

Equipment for Tibet

The last of three 36in spiral bevel gear units ordered from David Brown & Sons (Huddersfield), Ltd., has left the makers' works on the first stage of a long and difficult journey to Lhasa, capital of Tibet, where it will form part of a water turbine generating set which will provide Lhasa with its first public supply of electricity. The whole plant is of British manufacture and was specially designed by Gilbert Gilkes & Gordon, Ltd., Kendal.

The gear is required to transmit continuously 235 b.h.p. from a vertical shaft running at 232 r.p.m. to an horizontal shaft operating at 1,000 r.p.m.; it is totally enclosed and has its horizontal shaft extended approximately 3ft 6in beyond its bearing housing. The low speed vertical shaft is fitted with a David Brown rigid coupling, thrust rings, and an extra thrust bearing to accommodate an additional load of approximately 8,000 lb due to the weight of the rotating



One of three 36in spiral bevel gear units made by David Brown & Sons (Huddersfield), Ltd., for shipment to Tibet

parts of machinery. The makers have supplied a set of spare gears, shafts, bearings, oil pump, shaft extension and cover mounting.

As in the case of two gear units previously dispatched, the third one has been sent by sea to Calcutta, where it will be handed over to representatives of the Tibetan Government. Subsequently the equipment will go by rail to the Himalayan frontier town of Darjeeling; thence it will be carried in sections by mule and yak over the Himalayas to Lhasa.

Total weight of the assembled gear unit, with spares and accessories, is about 4½ tons. Since not more than one ton at a time can be manhandled across the icy Himalayan mountain passes, the unit was dismantled at the Huddersfield works and dispatched in six crates, each of an average weight of 15 cwt.

Time Switch Controlled Heating

An attractive Venner window plaque in the Regent Street showrooms of Hurseal, Ltd., has for its slogan "Set and Forget." As a hand moves round a clock face on which "peak times" are boldly marked, oil-filled electric radiators are turned "on" in various rooms at off-peak times and their use is reduced to the shortest possible time commensurate with comfort and convenience. When the "peak" period arrives, the radiators go off and the lights in the factory go on. This display shows the

A display in the Regent Street showrooms of Hurseal, Ltd., showing radiators controlled by a Venner time switch

invaluable service that the time switch renders in the interests of national economy. Lights switched on in the various rooms of a typical house indicate radiators "on," and the speeded-up Venner time switch completes the 24-hour daily cycle in one minute, enabling the layman to appreciate immediately the value of time switch controlled electric heating. At a time when certain Electricity Boards are introducing special tariffs for off-peak domestic loads the display brings home to the public the fact that electric space heating can be a distinct advantage to electricity undertakings by ensuring a better load factor.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £148 0s 0d
COPPER, H.C. Electro ..	ton £231 0s 0d
Fire Refined 99·7 per cent ..	ton £230 0s 0d
Fire Refined 99·2 per cent ..	ton £229 10s 0d
COPPER Tubes	lb 2s 2½d
Sheet	ton £285 0s 0d
H.C. wire and strip	ton £258 10s 0d
LEAD, English	ton £164 10s 0d
Foreign	ton £163 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £961 0s 0d
ZINC, G.O.B. Foreign	ton £190 0s 0d
Electrolytic	ton £191 0s 0d
BRASS Tubes	lb 2s 1¼d
Sheet	lb 2s 5¼d
Wire	lb 2s 8¼d
PHOSPHOR BRONZE	
Wire	lb 3s 8¼d
RUBBER, No. 1 R.S.S. spot ..	lb 32½d–33d

Global Quota Licences

The Board of Trade warns importers that the validity of licences issued against the global quotas established as a result of the "November cuts" will not, save in exceptional circumstances, be extended after 30th June, 1952. Importers are therefore advised to arrange shipments to come within the validity of the licences they hold. Except in special circumstances, the unused portion of any licence will not be carried forward to the new period and imports after 30th June will have to be debited against licences for the second half of 1952.

Trade Announcements

Mr. A. S. Dunstan, radio representative of **Siemens Electric Lamps & Supplies, Ltd.**, attached to the Newcastle Branch, is leaving to take up an appointment in Nigeria. Mr. K. Pattinson will succeed him on 1st May, as the company's radio representative for the four northern counties.

Mr. N. G. Payne has been appointed representative for Cheshire, North Wales and North Staffs, by **F. Westerman (Wholesale), Ltd.**, Birmingham.

The electrical wholesale business, previously known as J. Swindells & Co., Blackburn, has been acquired by **Gordon Wilson (Wholesale Electric), Ltd.**, as from 1st April, and will continue at 2, Park Road, Blackburn.

Mr. C. Gearing has been appointed sales representative for the Worcestershire, Gloucestershire and South Wales area for **Bill Switchgear, Ltd.**

The **Radio Resistor Co., Ltd.**, has been appointed sole distributor in the United Kingdom of the electronic components manufactured by Rosenthal Isolatoren of Bavaria.

Larger offices have been opened in London by **Barlow-Whitney, Ltd.**, at 2, Dorset Square, N.W.1. (telephone: Ambassador 5485). The Technical Sales Department will now operate from this address.

Catalogues and Lists

Nevelin Electric Co., Ltd., Purley Way, Croydon, Surrey.—34-page illustrated technical catalogue describing the "Nevelin" range of rectifiers (110).

Air Control Installations, Ltd., Ruislip, Middlesex.—Technical publications—"Airmat" dust arrestor (B521) and multi-duty air filter (B515).

Keith Blackman, Ltd., Mill Mead Road, Tottenham, London, N.17.—Illustrated booklet describing the complete range of "Extravent" fans including the recently developed type E.F.1 fan.

Diesel Generating Plant Order

Hampson Industries, Ltd., has obtained an order from the World Bank through the Marshall Aid programme for over £200,000 worth of diesel generating sets for the allied defence programme in the Far East. The sizes of the generating sets vary from 60 to 110 kVA. The order is a preliminary one and it is anticipated that further large orders will be forthcoming shortly.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Aston Silver" electric bells.

"Schorche" loom switches.

Socket Outlets Patent No. 239651.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Battery Electric Vehicles

Applications and Economics

AT a Utilization Section meeting of the Institution of Electrical Engineers in London last week two papers were presented on battery electric vehicles. The first was compiled by Mr. W. D. Sheers (Metropolitan-Vickers Electrical Co., Ltd.) and covered the general characteristics desirable in a battery-operated road vehicle, describing the battery, the type of drive from motor to wheel, the motor and the control gear, small auxiliary circuits, and maintenance.

The author pointed out that the type of vehicle under consideration was thoroughly appropriate for carrying out deliveries of goods especially where many stops had to be made, mainly owing to the lower maintenance than for horse-drawn or petrol vehicles. It was capable of withstanding the severe conditions of driving to which it was subjected. Mr. Sheers also referred to motors built into the wheels and to regenerative control, but suggested that the latter did not produce savings sufficient to repay the extra cost and complications.

Comparison of Cost

The second paper was read by Mr. H. W. Heyman (Smith's Electric Vehicles, Ltd.), who examined the economic features which had led during recent years to a spectacular increase, in this country more than elsewhere, in the number of battery-operated road vehicles. He showed that the cost of operation had moved in favour of the electric vehicle as a result of the longer battery life and the high cost of labour and petrol. In view of the long life of these vehicles a slightly higher first cost for a model of high efficiency giving the best possible performance was economic over a long period, and a formula to compare and evaluate the performances of different models was explained in detail. The choice of batteries was also discussed.

The potential market for battery vehicles was examined in the light of the limitation of range and flexibility and Mr. Heyman showed that the mass production methods of petrol vehicles could never be applied to battery vehicles. In conclusion, he suggested that a steady and increasing demand for new vehicles and replacements would call for a limited number of small, efficient manufacturers able to give personal service.

DISCUSSION

Mr. R. Birt (London Electricity Board) opened the discussion with the suggestion that a far more efficient way of adapting the electric vehicle to refuse collection purposes was by means of the "electric horse." If electric tractors were used with trailers for door-to-door collection and a "petrol horse" was used for taking the vehicle with its full load to the refuse dump or tip, it would be an economical way of dealing both with refuse collection and with the adaptation of the electric vehicle to that purpose.

Mr. C. P. Lockton (Chloride Batteries) expressed surprise at Mr. Sheers's recommendation of the installation of a battery relay as a safeguard against failure of the combined voltage relay and time switch. In his experience these devices were extremely reliable and instances of their failure at crucial periods were so few and far between that he would not have thought that the expense of an extra safeguard was justified.

Mr. W. Gilbert (Ransomes, Sims & Jefferies) referred to contactor controls and said that manufacturers should give some thought to developing contactors for l.v. heavy current. Generally speaking, if a suitable contactor were desired it was necessary to take one which had been designed for something like 660 V with arc shields. At 40 V, if the contactor were suitably designed, the arc shields could probably be completely eliminated, giving a cheaper and smaller product.

Mr. C. F. Atkinson (Nife Batteries) stated that there were over 3,000 alkaline batteries in use on industrial trucks in this country. They were of the flat-plate nickel-cadmium type. At the present time there was a substantial world market for battery propelled underground transport

and a very large proportion was equipped with the tubular-positive nickel-iron type battery. It was important to realize that a lead-acid battery should not be put in a vehicle designed primarily to take an alkaline battery, or vice versa.

Mr. E. W. Browning (London Co-operative Society) said that the pedestrian controlled vehicle had largely been ignored in the papers, but there had been a tendency over the last two or three years for that type to eliminate to some degree the electric road vehicle. Many roundsmen preferred the pedestrian controlled vehicle because they did not have to get in and out of the driving seat. One operator had 440 electric road vehicles as against 700 pedestrian controlled vehicles, and the gap was continually widening.

Colliery Transport

Mr. S. L. Cooke (National Coal Board) gave details of an investigation which had been made into the relative costs of transport by battery locomotive and diesel locomotive for coal transport underground. The investigation was by the Field Investigation Group of the N.C.B. in 1949 and was published in two papers presented to the Institution of Mining Engineers and to the National Association of Colliery Managers.

Mr. A. N. D. Kerr referred to Mr. Sheers's statement that in actual practice Class B insulating materials, such as glass and mica, were used throughout the machine, and said that the electric vehicle was, of course, "weaned" on Class A insulation. One manufacturer alone built 874 motors with Class A insulation.

Mr. J. H. Gosden (B.E.A.) said that experience in the electricity supply industry had shown that when battery road vehicles were used on appropriate duties they were both economical and convenient. There was ample scope for electric vehicles in the delivery of such commodities as bread and milk, but there was little likelihood that they would be used extensively in the electricity supply industry at the present stage of development. The principal limitation was that the weight of the battery restricted both the range and the pay-load of the vehicle. The British Electricity Authority was carrying out and encouraging in one of the universities long-term research into batteries of a type which might prove to be suitable for traction vehicle use.

Mr. W. Bamford (Everett, Edgecumbe) showed a slide illustrating a device which was available for indicating the capacity of a battery at any stage.

Mr. G. C. Allingham said he agreed that the alkaline battery had many advantages. During the past 10 or 20 years a very considerable number of road vehicles had been propelled by nickel-iron alkaline batteries and the owners of the vehicles would like to go on using them if only the batteries were more readily obtainable in this country.

Mr. A. D. Ferguson referred to fusing and said he did not like the idea that it was not necessary to protect the equipment and the battery. In his view it was very necessary that fuses should be provided, and should be placed as near the battery as possible.

Other speakers took part in the discussion to which the authors briefly replied.

E.A.W. Conference

THE twenty-seventh annual conference of the Electrical Association for Women to be held at Scarborough from 20th to 23rd May has a very full programme of business and social events. On the first day, Tuesday, 20th May, apart from registration at the Olympia Ballroom, there will be a golf competition for the Lady Hughman Challenge Bowl and also a putting competition.

Wednesday morning will be occupied by the annual general meeting, followed by the National Executive Committee meeting. At an open session in the afternoon an address will be given on "The Electron and Some of Its Applications," with demonstrations, by Mr. O. W. Humphreys, director of the G.E.C. Research Laboratories. Mr. H. H. Mullins, chairman of the North Eastern Electricity Board, Miss N. Balls, chairman of the Newcastle-upon-Tyne and District Branch, E.A.W., and the Mayor of Scarborough will also speak. There will be a civic reception in the evening.

Following a meeting of the National Advisory Council on the Thursday morning there will be the annual luncheon, at which the speakers will be the Mayor of Scarborough; Lord Citrine, chairman of the British Electricity Authority; Councillor Mrs. Letitia Bell, chairman, Newport (Mon.) Branch, E.A.W.; and Mrs. Mark Fraser, president, Carlisle Branch, E.A.W. The Dowager Lady Swaythling, president, E.A.W., will take the chair. In the evening the E.A.W. North Eastern Area Branches will give a party, including a concert and dancing. Visits have been arranged for the Friday morning to the North Tees power station and Paton & Baldwins' factory at Darlington.

Underwater Television

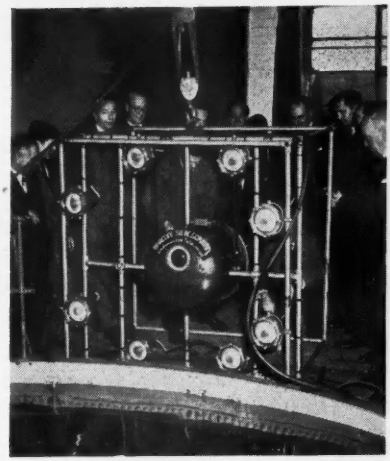
New Application Demonstrated

SINCE the Admiralty twelve months ago requested the help of Marconi's Wireless Telegraph Co., Ltd., in finding the lost submarine *Affray* with a television camera chain, the company has been investigating this new application of television and, during the past few months, has had the fullest co-operation of Siebe, Gorman & Co., Ltd., in the design of pressure cases and lighting gantries.

A demonstration last week at the latter's works at Tolworth showed the extreme sensitivity of the camera and illustrated the importance of this new development, particularly for underwater work where it would be dangerous for a diver to descend, for use at depths far greater than a diver's limit, and for enabling surface officers to direct operations. The television camera can work for far longer periods under water than a diver could and the "Image Orthicon" pick-up tubes used are far more sensitive and accurate than the human eye. Also the television picture received on board the ship can be filmed and a permanent record obtained.

The special facilities provided for underwater work with a television camera chain include remote focus and iris control, a flexible lighting system, special mounting facilities, an inclinometer, an alarm to show the presence of moisture within the pressure casing, and a remote bearing compass indicating the correct orientation of the camera.

The equipment has already proved highly successful in the finding of the *Affray* at a depth of 280ft and under test conditions some applications have already been thoroughly tried out—study of wrecks, finding of objects, and the investigation of the sea bed. Other applications presenting themselves are the study of fish in their natural surroundings, the investigation of trawl nets under operational conditions, identification and control of oyster and escallop beds, inspection of dock gates and ships below the water line, without employing divers or using dry docks, and the possibility of undertaking really deep-sea research at depths exceeding 1,000ft.



Marconi underwater television equipment being demonstrated at Siebe, Gorman & Co.'s works

Moisture in Soils

BUILDERS of generating stations and of foundations for overhead power lines will know that the "strength" of soil depends principally on the amount of water it contains. The stability of structures supported on soil can be affected by movements of moisture within the soil which, in turn, are governed by the reduced pressure (suction) at which moisture is held in soil.

Nine different methods of measuring this suction are described by the Road Research Laboratory (D.S.I.R.) in technical paper No. 24, price 2s 1½d post free (50 cents, U.S.A.) from H.M. Stationery Office. The electrical resistance gauge (which is described) is a means of continuously observing *in situ* suction changes in porous substances with which the gauge is in moisture equilibrium.

Measurements of this kind, by indicating the relationship between moisture content and suction, enable an estimate to be made of the final moisture condition and strength which will be reached in a soil foundation after movements of moisture have ceased. The suction of held-water rises from zero in materials immersed in water to thousands of atmospheres in an oven-dry material. No one method suffices over this wide range. The paper describes laboratory procedures for the nine principal methods and the range covered by each is stated.

NEW ZEALAND PROJECTS

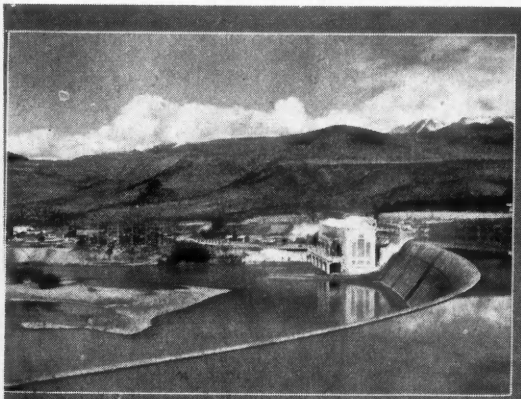
Progress of Major Hydro-Electric Works

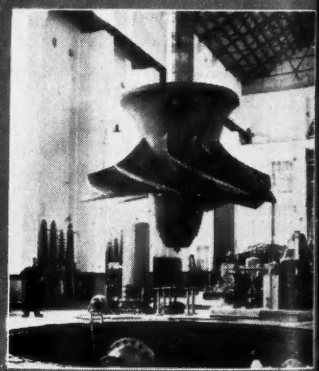
By E. SAMUEL

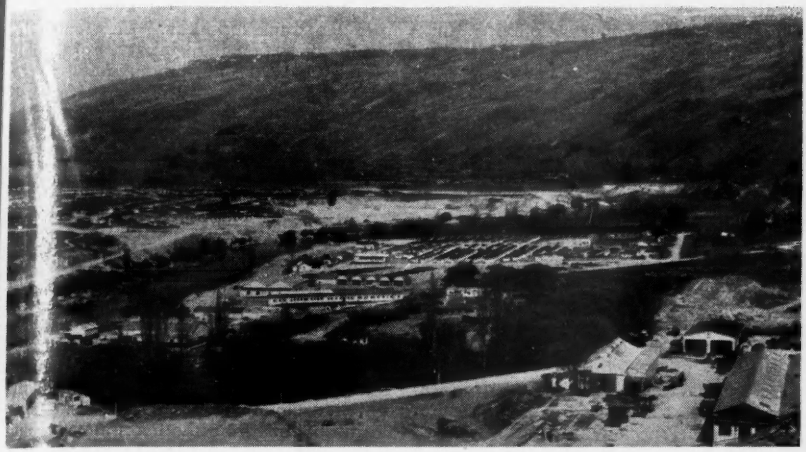
DESPITE setbacks caused by unusual climatic conditions all over the country, as well as manpower shortages, the progress of hydro-electric plant construction in New Zealand has been remarkably good and the delay in completion should not be great. In fact, there is every reason to believe that in three or four years the major portion of the whole network—the various schemes in the South Island and the Waikato River scheme from Taupo Lake downstream—will be in full operation.

This contribution is mainly pictorial, as it will perhaps in this way give readers a better idea of the importance and magnitude

The title picture shows the six-gated dam at Lake Pukaki, viewed from the outlet side, with the peaks of the Ben Ohau Range in background. Below (*left*) is a view of the 1,160ft dam at Lake Waitaki and (*right*) the interior of the station with the runner of No. 4 unit removed for overhaul





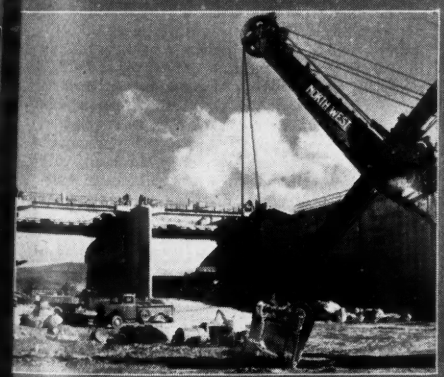


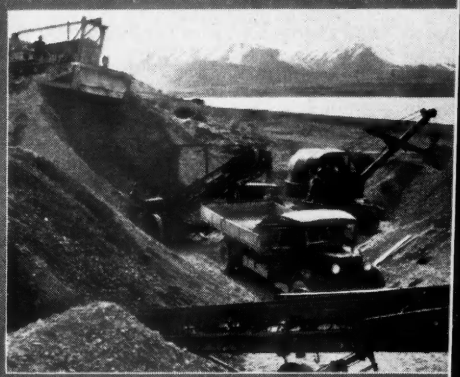
of the task undertaken by New Zealand, with a population of little more than two millions.

A few details first of progress in the South Island. At Cobb, work is a little behind schedule, but it is expected that the power house and penstock will be ready before the middle of next year, though the main dam may not be quite completed, perhaps until early in 1954. Farther south, at Tekapo, mechanical trouble was experienced but the generating unit has at last gone into operation. Work is now proceeding on the control dam, which it is anticipated will be completed by August, 1953. In the meantime a temporary coffer dam is being built and it is expected that before two years have elapsed it will be possible to obtain 90 per cent of the designed output under these conditions.

At Pukaki work is nearing completion, and for storage purposes the scheme can be considered to be in operation. The installation of two new units at Waitaki

Above is a general view of the extensive public works settlement area at Coal Creek for the Roxburgh hydro-electric scheme. Below (*left*) work is shown in progress on the inner side of the dam at Lake Pukaki. Heavy machinery is used wherever possible to accelerate urgent construction work; at Lake Tekapo (*right*) two endless conveyor machines are seen loading trucks with pea gravel





is a little behind schedule and measures are being taken to ensure completion of this important project in 1954. Similarly at Roxburgh, the biggest scheme of all, construction is being speeded up to keep to the scheduled time for operation, 1956. At Waipori, the project sponsored by the Dunedin City Council, it appears certain that, all being well, No. 3 station will be in operation by the middle of 1953 and No. 4 station before the end of that year.

So much for the South Island. The North Island has had perhaps even greater difficulties and obstacles to overcome. The present programme is to fill Lake Taupo to give a head of about half the normal amount by about October of this year. At this stage the use of the diversion tunnel will cease and water will be passed either through the turbines or through the penstocks, left specially for this purpose. If possible, three machines will be run at this reduced head, and if no trouble ensues with the open penstocks, it may be possible to obtain a total of 30,000 kW from the three machines. The old diversion tunnel then has to be plugged with concrete at the end of the present year, when the full output of 108,000 kW should be available from the three machines. The fourth is due for operation in February, 1953, and the fifth and final machine in May, 1954.

Investigation work at Waipapa is essentially complete and the layout design work is well in hand. At Waikaremoana the leak-sealing has progressed almost as far as seems possible, but further work is being attempted while the level of the lake is low. The indications are that 60 per cent sealing instead of the estimated 75 per cent will be attained. The construction of the spillway is now being carried out.

In conclusion, I should like to refer to the very important investigations at Wairakei, in the centre of the North Island, into sources of geothermal power. New drilling equipment is being obtained in order to explore to greater depths. The steam obtained from the bores already put down to 1,000ft is generally mixed with water, but a recent still lower bore gave dry steam for several days. The results to date show the necessity for exploring the lower level, but the quantity of heat obtained even now is of considerable magnitude—altogether the outlook is promising.

LUMINESCENCE

A PAPER on luminescence by Messrs. H. G. Jenkins and A. H. McKeag was delivered recently to the Illuminating Engineering Society in London. The first portion indicated the main features of photoluminescence as utilized in fluorescent lamps, followed by an outline of the theory and an account of the chemical, physical and luminous characteristics of the more important phosphors.

The more general matters referred to in the later portion of the paper included fluorescent glass, the more complex structure of which renders its luminescence less understood even than that of crystalline substances. Glasses activated by molecular groups as well as by neutral metallic atoms were known. The latter types were not satisfactory for lamps unless the iron content was very small. Those glasses, because they were expensive, were generally used in the form of a thin internal flashing on normal glass, which was sometimes coloured to increase the range of resultant colours. Efficiencies were about half those obtained with normal phosphors and, apart from a limited use for neon signs, fluorescent glasses were not widely utilized.

Fluorescent paints made from sulphide phosphors were available in a range of colours and when used in conjunction with "black glass" lamps produced effects of artistic merit. Unlike ordinary paints, fluorescent pigments gave additive mixtures of light when blended in the usual manner. More recently lacquers containing fluorescent dyes had been widely used for advertising; the near u.v. and blue radiation in daylight excited the luminescence which was seen as a brightening of the colour of the dye.

The excitation of phosphors by means of a varying electric field was known as electro-luminescence. The phosphor was incorporated in the dielectric of a simple capacitor, one of the plates of which was a transparent conducting film on a sheet of glass and the other a thin metallic film in close contact with the phosphor, the plates being spaced about 0·1 mm apart. At mains voltage and frequency the luminosity was low, but increased with voltage and frequency. The spectral distribution of the light was also modified slightly at higher frequencies. At power frequencies high voltages were required to obtain a worthwhile light output, but the problem of making luminous capacitors to withstand those voltages had yet to be solved. The effect had been applied to instrument lighting, luminous dials and even to lighting installations, but much progress would have to be made before this interesting phenomenon could be regarded as a serious lighting "tool."

ELECTRICITY SUPPLY

Generation Figures for First Quarter

Scottish System Improvement

FIGURES for the first quarter of the year published by the Ministry of Fuel and Power show a rise of 5·1 per cent in electricity generated by the British Electricity Authority, the North of Scotland Hydro-Electric Board and the Lochaber Power Co. In the same period the installed plant capacity increased by 171 MW (1 per cent) to 16,499 MW. Last month 148 MW was added, plant commissioned in B.E.A. stations including the following:—

Blackwall Point: 365,000 lb/hr Babcock & Wilcox boiler. Brunswick Wharf: 52·5 MW Metropolitan-Vickers turbo-alternator and two 320,000 lb/hr Clarke Chapman boilers. Rye House: 32 MW Richardsons-Westgarth and C. A. Parsons set and 350,000 lb/hr B. & W. boiler. Westwood: 300,000 lb/hr B. & W. boiler. West Ham "B": 30 MW English Electric set and 180,000 lb/hr John Thompson boiler. Portsmouth: 30 MW B.T.H. set and two 180,000 lb/hr Mitchell boilers. Warrington: 200,000 lb/hr Simon Carves boiler.

On 5th April coal stocks at power stations totalled 4,107,000 tons (equivalent to 4·4 winter weeks' consumption) compared with 2,618,000 tons (3·4 weeks) a year ago.

Height of 275 kV Lines

Recently Stockton-on-Tees Town Council protested against the British Electricity Authority being given permission to erect 275 kV overhead transmission lines in the western part of the town which might hinder development. In a letter to the Council the B.E.A. says that although it would not be justified in incurring heavy expenditure at this stage in heightening the lines, in the event of the position changing, it would be prepared to discuss with the Council any steps with regard to the height of the lines which might then be appropriate.

Dumfriesshire Reinforcement

In view of the growth in the demand for electricity in the north-west part of Dumfriesshire, the S.W. Scotland Electricity Board has approved a scheme to reinforce the electricity network in that area at an estimated cost of £93,200. The scheme, which it is hoped to complete in three years, provides for the erection of a second 33 kV overhead line with a rating of 20 MVA for a distance of 15 miles from Dumfries to Penpont to supplement the existing line. In addition a 33/11 kV substation will be constructed at Penpont with two 5 MVA transformers and switchgear to control the existing 33 kV line to Kirkconnel, a further 15 miles north of Penpont.

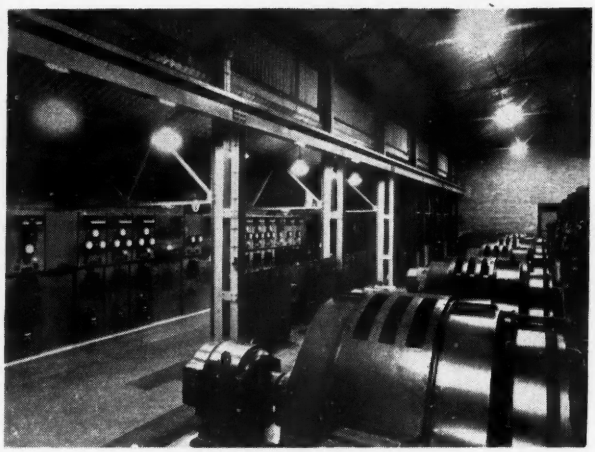
Development in North-East

The quarterly report of the North Eastern Electricity Board submitted to the Consultative Council at Newcastle-on-Tyne stated that during the period 80 new substations were brought into operation in the area and 95 farms were connected. The Board had approved estimates amounting to £705,170 covering schemes for 98 housing and 30 rural supplies. The present capital allocation for 1952–53

ELECTRICITY GENERATED IN MARCH AND PLANT CAPACITY

	Fuel consumed Thousand tons		kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Oil	Steam	Water	Total*		
British Electricity Authority ..	3,014	5·0	5,349	37	5,395	5,083	15,855
North of Scotland	9	1·1	12	137	154	153	644
Total for March, 1952 ..	3,023	6·1	5,361	174	5,549	5,236	16,499
Corresponding total for March, 1951	3,163	9·0	5,396	135	5,550	5,247	15,168
Increase or decrease, per cent ..	−4·4	−32·2	−0·6	+28·9	—	−0·2	+8·8
Total for year to date (3 months), 1952	9,806	21·9	17,091	550	17,688	16,708	
Total for corresponding months of 1951	9,642	29·6	16,364	413	16,835	15,926	
Increase or decrease, per cent ..	+1·7	−26·0	+4·4	+33·2	+5·1	+4·9	

* The total includes 8·5 million kWh generated by oil engines and 5·1 million kWh by waste heat plants in March, 1952.



The Peel power station of the Isle of Man Electricity Board, in which "Mazda" lighting fittings have been installed

would allow Stage 2 of the rural development scheme to be completed and supplies provided for nine more villages, and in addition a start would be possible on supplying villages under Stage 3 of the scheme. This included 28 villages in the Tyne area, two in the Wear area, three on Teesside, 10 in the York area, and 14 in the Harrogate area. During the past quarter the Board had afforded h.v. supplies to 18 industrial and commercial consumers. It was making a start on supplying villages at present served from networks owned by the National Coal Board.

Glen Lussa Scheme Extension

The North of Scotland Hydro-Electric Board is to extend the Glen Lussa scheme, increasing its output by about 2,250,000 kWh per annum. Water from upper tributaries of the River Barr will be led by a tunnel 2¼ miles in length to feed into the reservoir of the main scheme. The first turbine of the Glen Lussa scheme is already supplying Campbeltown and the coastal villages, farms and cottages on the east and west sides of the Kintyre Peninsula.

Electrical Installations

Leamington Spa Corporation Housing Committee reports that the Ministry of Housing and Local Government has approved proposals for the installation of electricity in 252 Council houses at an estimated cost of £8,000.

Power Station Lighting

Engineers of the British Thomson-Houston Co., Ltd., in collaboration with Peel power station engineers, have completed a large-scale lighting scheme at the power station of the Isle of Man Electricity Board. Main lighting is provided by ten "Mazda Glassteel" diffusers housing 500 W lamps and, under bays, seventeen similar fittings housing 150–200 W lamps. The 500 W units have been mounted at approximately 20ft and the 150–200 W units at approximately 10ft from floor level. In addition, several directional prismatic fittings have been erected on a wall behind the main switchboard for the purpose of throwing light into the cubicles when they are opened. The estimated intensity is in the region of 20 lumens per sq ft.

Keadby's First Set Starts

It is reported that the first 60 MW set at the new Keadby power station, near Scunthorpe, has been placed in commission. Construction of the station was begun four years ago and completion is scheduled for 1955, when the total capacity will be 360 MW.

Hull Telephone Charges

The Hull telephone undertaking—the only municipally controlled service of its kind in the country—has announced increased charges to come into force next July. The unlimited business tariff will go up from £13 16s to £18 a year and the unlimited private house tariff from £7 10s to £9. There will be proportionate increases for measured services and party lines and the 1d charge for calls from public kiosks will be raised to 2d. These charges are estimated to provide a surplus of £13,084 for the current financial year instead of the anticipated £16,938 deficit on the basis of existing charges.

Wash-House Modernization

Leeds Corporation Baths Committee proposes to install 32 electric washing machines, at a cost of £12,000, to replace hand machines at four public wash-houses in the city.

Electricity in the Hebrides

Seil (population 300), off the Argyll coast, will be the first island in the Inner Hebrides to be linked with the North of Scotland Hydro-Electric Board's system at Oban.

Engineering in Europe

Survey of Current Literature

THE causes of the transverse oscillations of overhead conductors were discovered as long ago as 1912 by Karman and Rumbach. They are shocks due to intermittently detaching eddy trails of air in a harmonic sequence coinciding with one of the natural frequencies of the conductor. Their effects were negligible so long as tenacious metals like copper and steel were the only conductor materials used in overhead line construction, but matters changed with the introduction of aluminium and its alloys as a conductor material. Remedies suggested, such as damping conductor arrangements or the use of mechanical shock divertors, answer on the whole very well and would seem to dispose of the problem. But an economic problem remains, because steel-aluminium conductors may not be stressed as highly as heavy-metal conductors and the material cannot therefore be fully utilized. Also, the span lengths have to be reduced, which is another economic drawback, the reason being that the tendency to vibrate increases with the length of the span. The probability of vibration varies actually with a higher power of the span length and beyond a certain limit there must exist a practically infinite number (or "continuous spectrum") of natural frequencies of the conductors, one or more of which *must* be excited at any moment by air currents, however weak.

A simpler means to shorten the dangerous span length is the use of artificial nodes or stiffeners on the conductor, preferably at unequal spacings, so as to impede the propagation of vibrations along the conductor and to avoid resonance phenomena. Another solution would be to alter the design of the composite line so that the aluminium, Aldrey, or electron conductors are sheathed with a metal of high elastic modulus, e.g., copper or bronze (steel being unsuitable). The oscillations of the light-metal cores would thus be prevented from reaching dangerous amplitudes. A third means suggested is to use eddy-current brakes or dampers to convert the vibration energy into heat, which is quickly carried off.—"Vibrations of Light-Metal Overhead Line Conductors," K. Kohler, *Bulletin* Assoc. Suisse des Electriciens, Vol. 42, No. 25, pp. 1003–1005, 15th December, 1951, in German.

Single-Phase Traction

Contributors to a symposium on this subject last year included such leading firms in the electrification of the French railways as Alsthom, Jeumont and Oerlikon. After a general survey of development in various countries, the individual contributions concerned the effects of single-phase railway loads on three-phase power supply systems, disequilibrium problems involved and how to deal with them by suitable distribution and equipment of the traction substations; voltage drops in the spans, their effect in single-phase traction and their reduction; discussion of a concrete solution.

Comparisons were made of the characteristics of d.c. with those of $16\frac{2}{3}$ and 50 c/s single-phase traction and other subjects were high-power locomotives and motor units for 50 c/s single-phase; dual-system locomotives; 50 c/s single-phase traction motors; a special type of single-collector 50 c/s traction motor of 720 h.p.; locomotives and rail-coaches for alternative or combined 20 kV single-phase/1,500 V d.c. traction (Muller's solution); comparison of rectifier and single-phase traction locomotives; difficulties with traction motors supplied with undulating current from rectifiers (temperature rise, commutation, speed control); characteristics of traction rectifiers and their auxiliaries, and of rectifier-locomotives; phase and frequency convertors in traction supplying induction motors; variable-frequency transmission and starting; short-circuited rotor motors in traction at variable frequency; report on research and

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

inquiries of the French railways on single-phase traction (German, Austrian and French experimental lines and experience gathered on them) (B.B.C., A.E.G., S.S.W., Krupp locomotives and the BB and CC types of the French railways); the geometry of the single-phase motor; slot and brush problems (wear); collector eccentricity; influence of the type of locomotive on the line voltage; and economic questions, service life and maintenance of the locomotives.—" Symposium on Single-Phase Traction at 50 c/s," *Bulletin Société Française des Electriciens*, Ser. 7, Vol. 1, pp. 514–612, September, 1951, in French.

Lightning Protection

The reconstituted committees for the protection against lightning of buildings in the " German Federal Republic " as well as in the " German Democratic Republic " have revised the Regulations for the Lightning Protection of Buildings (first published as a book entitled " Lightning Protection " in 1924). An essential improvement is that the former main principle that the earthing contact resistance of the arrestor installation shall be the lowest among all the earthing resistances obtainable in the neighbourhood, shall no longer be regarded as the only decisive factor because it disregarded the most important danger of back-flashovers. It is at least equally important to remove any opportunity for the discharge current to leap to a neighbouring more convenient, shorter or straighter, path to earth which might endanger the building and its inhabitants. Thus the Regulations now deal in far more detail with the geometry and topology of the design of earth connections, their characteristic impedances and the avoidance of potential differences being set up between certain critical points of the arrestor installation. A few clear relations, or criteria, are established which permit of solving such, and allied, problems in the design of arrestor installations, due regard being paid to the characteristic features of the building and its site.—" New Ideas on Lightning Protection of Buildings," H. F. Schwenkhagen, *E.T.Z.*, Vol. 73, No. 3, pp. 63–68, 1st February, 1952, in German.

Transformer Over-Currents

Exact methods for predicting over-current characteristics of current transformers do not exist and are impossible of attainment, owing to the distortion of secondary current and terminal voltage in the range of over-currents. In this range the flux passes through the saturation range of the iron once during every half-period, resulting in the setting up of a considerable positive 3rd harmonic (so that the flux-wave becomes flat-topped). The induced voltage wave, containing a negative 3rd harmonic three times as strong as that of the flux wave, then becomes sharply pointed. For a non-inductive burden the secondary current wave will correspond with this voltage wave (if leakage voltage is negligible) whereas with an inductive burden both inductance and secondary leakage reactance reduce the harmonic content.

Oscillograms taken on protective current transformers show that the secondary current in the over-current range increases without noticeable limit when the over-current rating is exceeded. This increase is absolute as well as relative to the primary current (although the relative increment is small). Actually dangerous is the increase of the secondary terminal voltage, which is far in excess of the prescribed test voltages. Suggestions for a revision of the existing regulations by altering test voltages of secondary windings and of the protective gear to be controlled by the transformers, and also of the connecting leads, are made. Secondary currents of 1 A for a full burden should be avoided.—" Behaviour of Current-Transformers in the Range of Over-currents," A. Kaltofen, *E.T.Z.*, Vol. 72, pp. 707–710, 15th December, 1951, in German.

Atomic Power Prospect

THE *Daily Telegraph* Science Correspondent, Leonard Bertin, quotes Mr. Gordon Dean, chairman of the United States Atomic Energy Commission, as saying that cities in countries like Great Britain would be lit by atomic power within fifteen years. Mr. Dean said that Great Britain was likely to beat the United States in this respect because it had the incentive of dear coal to speed development and Great Britain was devoting greater attention to the peaceful uses of atomic power.

Mr. Bertin refers to the new atomic pile at Harwell which will be smaller and cheaper than the experimental pile (B.E.P.O.) of which some particulars have been published. It will operate at 600 deg C, three times the temperature of the experimental pile. The construction of this and possibly several other research reactors is likely to be completed in three or four years.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

British Insulated Callender's Cables, Ltd reports a trading profit for 1951 of £7,986,464, as compared with £6,130,642 for 1950, to which is added investment income of £122,278, profit on realization of property and investments £29,517, and provisions no longer required £169,780, making £8,288,039. After meeting all charges, including £845,836 for depreciation and £4,081,211 for taxation, the net profit is £3,054,868 (against £2,309,147), of which £2,696,866 is attributable to the holding company. Capital reserves receive £5,303 and revenue reserves £1,938,013, and it is proposed to pay a final ordinary dividend of 5½ per cent and a bonus of 1½ per cent, making a total distribution for the year of 9 per cent. The distribution for 1950 was 7½ per cent.

The directors announce that the recent rights issue of 3,109,614 £1 ordinary shares at 22s per share was considerably over-subscribed. Acceptances representing 92 per cent of the shares offered have been received and applications for additional shares considerably exceed the shares available. After allocating rights, applications up to 50 additional shares have been allotted in full, all others being progressively scaled down with a maximum individual allotment of 250 shares.

Thomas Bolton & Sons, Ltd.—The annual meeting was held on 16th April, Mr. P. V. Hunter (chairman) presiding. In his circulated statement, the chairman said that their wide knowledge of metallurgy and the great variety of their products had enabled them to render considerable assistance to their customers by substituting materials more readily available for those which would normally be used. Referring to their investment in the United Sulphuric Acid Corporation, the chairman said that copper sulphate was at present largely manufactured from imported materials the supply of which could not be relied upon. They had therefore joined with other firms in the formation of this company, which was about to install plant for the manufacture of acid; their future supplies would thus be made secure.

C. A. Parsons & Co., Ltd., in a preliminary statement, report a profit for 1951 of £2,223,952, as compared with £1,454,589 for the preceding year. Taxation requires £1,156,500 and contingencies £30,000, leaving a net profit of £1,037,452 (against £656,589). It is proposed to pay a final ordinary dividend on capital as increased by a 100 per cent scrip bonus made in October last, of 6¼ per cent, making with the interim of 7½ per cent on the old capital, 13¾ per cent for the year (against 15 per cent).

Lancashire Dynamo Holdings, Ltd., reports a group profit, before taxation, of £481,082 for 1951, as compared with £401,692 for the previous year. After deducting taxation of £277,925, and adding provisions in previous years no longer required of £18,556, the balance available is £221,713 (against £214,755). £52,263 is retained in subsidiaries.

It is proposed to pay a final dividend on the ordinary stock of 8½ per cent, making 12½ per cent for the year. For the previous year the distribution was 22½ per cent, which was paid on half the present ordinary capital.

The Ever Ready Co. (Great Britain), Ltd., reports a consolidated net profit, after all charges, including £469,566 for taxation, of £364,584 for the year ended 29th February last, as compared with £333,512 for the preceding year. The ordinary dividend is maintained at 35 per cent for the year with a final payment of 20 per cent, and a final dividend of 5 per cent (same) is recommended on the 7 per cent cumulative participating preference capital, making the maximum of 10 per cent for the year (same).

Blaw Knox, Ltd., report a trading profit for 1951 of £401,708, and a net profit of £121,028. The final ordinary dividend is 20 per cent, making 30 per cent for the year.

In his circulated statement, Mr. J. T. Goddard (chairman) says that their Transmission Tower Department has secured contracts from Canada, New Zealand, India, Pakistan, South Africa, Uganda, Colombia, etc., and in addition, orders have been obtained from the British Electricity Authority for transmission towers for their 132 kV lines, as well as towers for the 275 kV lines from Clyde's Mill to West Melton, Tilbury to Elstree and Staythorpe to Elstree.

Charles Clifford & Son, Ltd., report a trading profit for 1951 of £186,736, as compared with £115,770 for the preceding year, and after meeting all charges, including £104,500 for taxation, there is a net profit of £82,647 (against £59,170), to which is added £50,896 brought in, making £133,543. After making allocations totalling £64,000, it is proposed to pay a final ordinary dividend of

17½ per cent, making 22½ per cent for the year. The balance carried forward is £50,880.

The Chloride Electrical Storage Co., Ltd., in a preliminary statement, reports a profit for 1951, after allowing £1,573,173 for taxation, of £1,386,272, as compared with £1,103,506 for 1950. After making various provisions, including £204,703 depreciation and profits retained by subsidiaries, there is a balance available of £870,004 (against £822,069). The final dividend on the "A" and "B" ordinary stock is 10 per cent, maintaining the total for the year at 15 per cent.

Hopkinsons, Ltd., report a net profit for the year ended 31st January last of £345,380, as compared with £348,812 for the preceding year. Reserves receive £256,000 and it is proposed to pay a final ordinary dividend of 20 per cent (against 17½ per cent), making 27½ per cent for the year (against 25 per cent). The balance carried forward is £450,859 (against £424,873 brought in).

Glenfield & Kennedy, Ltd., report a consolidated net profit for 1951, after deducting £752,039 for taxation, of £453,929, as compared with £399,970 for 1950. The profit of the parent company is £377,683 (against £301,985). It is proposed to pay a final ordinary dividend of 10 per cent, plus a centenary bonus of 2½ per cent, making 17½ per cent for the year on capital doubled by a 100 per cent scrip bonus last May. The distribution for 1950 on the smaller capital was 25 per cent. The carry-forward is £88,134 (against £61,290 brought in).

The British Electric Resistance Co., Ltd., is paying an unchanged interim dividend of 5 per cent.

McMichael Radio, Ltd., reports a net profit for 1951 of £22,186, as compared with £19,650 for 1950. The dividend for the year is unchanged at 8 per cent.

Mavor & Coulson, Ltd., propose to pay an unchanged dividend for the past year of 20 per cent.

New Companies

Lancashire Dynamo Switchgear, Ltd.—Registered 9th April. Capital £100. Mechanical, electrical and hydraulic engineers, manufacturers of and dealers in electrical apparatus and equipment (including radio and television), etc. Directors: H. W. Bosworth, J. G. Shaw, S. G. Mundy and R. E. V. Ely (all directors of Lancashire Dynamo Holdings, Ltd.). Regd. office: Bristol Road, Bridgwater, Somerset.

L. Jones (Electrical), Ltd.—Registered 4th April. Capital £10,000. Wholesale dealers in and manufacturers of artificial lighting apparatus, electrical plant, wireless and television sets, etc. L. Jones is permanent managing director. Regd. office: Hepper House, East Parade, Leeds, 1.

Perrett & Couchman, Ltd.—Registered 4th April. Capital £500. Manufacturers and repairers of and dealers in wireless and television sets, artificial lighting apparatus and electrical fittings, etc. Directors: P. A. Perrett and H. S. Couchman. Regd. office: 79, Mount Pleasant, Tunbridge Wells, Kent.

Radio House (Macclesfield), Ltd.—Registered 3rd April. Capital £1,500. Manufacturers, servicers and repairers of and dealers in electric batteries, lamps, radiators, fires, cookers, irons, vacuum cleaners, electrical and wireless goods, etc. Directors: G. Parker, Edith Parker and J. Abraham. Regd. office: 62, Chestergate, Macclesfield.

Hawes Electric, Ltd.—Registered 5th April. Capital £1,000. Manufacturers of electric elements, heaters, thermostatic control switches and devices; electrical engineers, etc. Directors: J. P. Suggitt, C. Cash, Mrs. A. Wilson and R. J. Cash. Secretary: Alice Wilson. Regd. office: The Hawes, Friends Lane, Great Sankey, near Warrington.

Electran Coil Winding & Transformer Co., Ltd.—Registered 10th April. Capital £100. To acquire the business of the Electran Coil Winding & Transformer Co., and to carry on the business of electrical engineers and contractors, etc. The first directors are to be appointed by the subscribers. Solicitors: Stephenson Harwood & Tatham, 16, Old Broad Street, E.C.2.

J. Fennell (Coventry), Ltd.—Registered 29th March. Capital £5,000. To acquire the business of "J. Fennell" carried on by Walter J. Fennell at Spon Street, Coventry, and to carry on the business of dealers in electrical and mechanical apparatus and accessories, wireless sets, etc. Directors: W. J. Fennell and Mrs. Emily L. Fennell. Regd. office: 158, Spon Street, Coventry.

Richard Burbidge & Co., Ltd.—Registered 10th April. Capital £2,000. Electrical contractors, manufacturers, repairers, importers and distributors of electrical goods, including dynamos, armatures, etc. The first directors are to be appointed by the subscribers. Regd. office: 15, Ship Street, Brighton, Sussex.

Liquidation

Electra Sales (Essex), Ltd.—Creditors' voluntary liquidation. Particulars of claims to the liquidator, Mr. F. Goodman, 3, Broad Street Buildings, Liverpool Street, London, E.C.2, by 7th May.

Bankruptcy

J. V. Barke, 21, Circular Drive, Chester, electrical engineer.—Receiving order made 28th February on a creditor's petition.

STOCKS and SHARES

FOR a continuing recovery in the prices of gilt-edged stocks, chief credit seems to be largely due to the performance of the pound sterling in the foreign exchange market. With encouragement from that important direction, investment is regarding with less suspicion the comparatively attractive yields offered by Government securities, and the substantial capital profits which will accrue at maturity to a buyer of a number of the redeemable issues, such as the British Electricity stocks, at to-day's discounts. It cannot be said that recent buying has been particularly impressive in volume or in origin, or that there are many signs of conviction, among the "institutional" investors, that the raising of interest rates, as a matter of Government policy, has yet run its full course. Nevertheless, there are at least the beginnings of a return of confidence, and there is little doubt that recovery in the prices of industrial shares owes part of its inspiration to the lead of the gilt-edged market.

C. A. Parsons Dividend

Another big advance in C. A. Parsons earnings has taken net taxed profits over the million mark, or more than 50 per cent above last year's figure. Following the news, and the declaration of a 6¼ per cent final dividend, the £1 ordinary shares improved to 46s 3d. A capital bonus of 100 per cent intervened between the latest payment and the 7½ per cent interim for 1951, so that the total for the year is equivalent to 10 per cent (compared with 7½ per cent previously) on the present capital. As in the case, however, of the associated A. Reyrolle & Co., which made similar distributions for the year, the final of 6¼ per cent encourages the market to value the shares provisionally on the basis of a 12½ per cent annual rate. On that assumption, the shares show a yield of £5 7s 0d per cent, compared with under 4½ per cent on the basis of the actual payments for 1951. In either case, the distribution would remain among the most highly conservative in the industrial list.

B.I.C.C. Results

Last week's jump in the price of British Insulated Callender's Cables ordinary shares from 26s 6d to 29s 9d showed that expectations were more than merely satisfied with increases in the total distribution from 7½ to 9 per cent, and in the year's group net profit from £2·3 to over £3 million. Shareholders who subscribed to the recent issue of new shares at 22s have reason to be particularly pleased, although they do not participate in this payment. The actual results show up well in comparison with the advice, given to them at the time, to the effect that profits would show improvement and would suffice to maintain the old rate of dividend on the larger capital. Preliminary profits figures indicate the ordinary distribution to take less than one-fifth of the distributable surplus. At the new rate, the shares are now on a yield basis of nearly 6¾ per cent, which compares favourably with returns of less than 6 per cent from a number of other leaders in the electrical equipment market. The new shares, 10s paid, with a final call of 12s due on 23rd May, are quoted at 17s 7½d.

More Dividends

Ever Ready is bringing its total ordinary dividend for the year to 35 per cent as before, but, according to the preliminary figures, with a satisfactorily wider margin this time between earnings and distributions. The results were well received, the price of the 5s shares hardening to 24s 6d. Lancashire Dynamo's total dividend of 12½ per cent applies to capital double that of a year ago, when 22½ per cent was paid, so that shareholders are receiving a modest participation in the increased profits. Vickers are again paying 12½ per cent for the year, but despite the chairman's cautionary note at last year's meeting, the fall of three-quarters of a million in the group profit, after tax, caused disappointment and a drop of 1s 6d in the price of the ordinary shares to 46s. Newman Industries 2s ordinary are unchanged at 2s 9d: the dividend is raised to 10 per cent against 6 per cent a year ago, and the participating preferred are to receive 8 per cent, an advance of 2 per cent.

Market Notes

British Aluminium's full report showed that the increase in the distribution from 10 to 12 per cent was accompanied by a rise in earnings from the equivalent of 28 to 38 per cent on the ordinary capital. Calculations of the effect of the excess profits levy, as it now stands, reduce almost to the absurd some cases in which large capital repayments have been made: "standard" profits of Cable & Wireless (Holding), for instance, can be shown to work out as a minus quantity.

McMichael Radio 5s shares remained quoted at 3s ex dividend after news of the maintenance of the dividend at 8 per cent, and of the increase in profits. Murphy Radio improved to 7s on further consideration of the recently published results. Dealings are taking place in the new Telephone & General Trust ordinary shares at a premium of 3s 3d on the price of 23s, at which they are offered to shareholders. The increase in capital is unlikely to break the long line of 8 per cent ordinary dividends, so that the prospective yield at the all-in price is nearly 6¼ per cent.

Electrical Investments

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price April 21, 1952	Week's Rise or Fall	Est. Yield p.c.
Gilt-edged and Overseas Stocks			£ s d		
Brit. Elec. 1968/73	3	3	83½	+½	3 11 10
Brit. Elec. 1974/77	3	3	82½	+½	3 12 9
Brit. Elec. 1976/79	3½	3½	88½	+½	3 19 0
Atlas Elec. ..	3	4	18/6	—	4 6 6
Calcutta Elec. ..	6†	6†	19/6	—	6 3 1†
East African Power	7	7	28/3	—	4 19 1
Nigerian Elec. ..	10	10	25/3	—	7 18 5
Palestine Elec."A"	5†	5†	14/3	+6d	7 0 4†
Perak Hydro-Elec.	Nil	Nil	12/-	—	—
Equipment and Manufacturing					
Aberdare Cables(5/-)	20	20	11/6	—	8 13 10
Aerialite (1/-) ..	83½	88½	8/3	—	10 14 0
Aron Elec. Ord. ..	15	15	32/6	−⅛	9 4 6
Assoc. Elec. Ord.	20	20	68/6	—	5 16 0
Automatic Tel.& El.	12½	15	57/6	+2/3	5 4 4
Babcock & Wilcox	15	18	67/6	+1/9	5 7 2
Baldwin, H. J.(2/-)	25	25	4/9	—	10 10 6
British Aluminium	10	12	40/3	—	5 19 8
B.I. Callender's ..	7½	9	29/9	+3/3d	6 1 0
British Thermostat (5/-)	30	30	27/-	—	5 11 1
British Vac.Cleaner (5/-)	25	25	14/-	—	8 18 6
Brook Motors ..	20	20	32/-	—	6 5 0
Brush Ord. (5/-) ..	10	10	5/6	—	9 1 10
Burco (5/-) ..	42½	38½	18/9	—	9 18 6
Chloride El.Storage	12½	15	60/-	+½	5 0 0
Cole, E. K. (5/-) ..	20	25	15/6	+6d	6 9 0*
Cossor, A. C. (5/-)	Nil	Nil	13/-	+6d	—
Crabtree (10/-) ..	17½	17½	31/3	—	5 12 0
Crompton Parkinson Ord. (5/-) ..	11¼	11¼	9/-	+3d	6 5 0
De La Rue (5/-) ..	50	50	15/9xb	—	7 18 9*
Decca (1/-) ..	112½	112½	17/-	- 6d	6 12 4
E.M.I. (10/-) ..	8	12	16/3	+9d	7 7 7
Electrical Components (5/-) ..	20	20	11/3	—	8 17 10
Elec. Construction	15	15	47/6	—	6 6 3
Enfield Cable Ord.	7½	7½	27/-	+1/-	5 11 0
English Electric ..	15	15	54/6	—	5 10 1
Ericsson Tel. (5/-)	22†	22†	37/6	—	2 18 9†
Ever Ready (5/-)	35	35	24/6	+6d	7 2 10
Falk Stadelmann	15	15	37/6	—	8 0 0
G.E.C. Ord. ..	17½	22½	79/6	+1/6	5 13 3
General Cables (5/-)	38	30*	17/6	—	8 11 6
Greenwood & Batley	15	15	41/3	—	7 5 0
Hackbridge Cable (5/-)	20	20	10/3	—	9 15 0
HackbridgeHewittic (5/-)	15	18	14/6	—	6 4 2
Hall Tel. Acc. (10/-)	10	10	11/6	—	8 13 10
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (5/-) ..	20	20	19/-	—	5 5 3
Hoover (5/-) ..	37½	35*	25/9	+6d	6 16 0
Intl. Combustion (5/-)	20	25	21/9	—	5 15 0
Johnson & Phillips	15	15	48/9	+6d	6 3 0

Company	Dividend Previous	Dividend Last	Middle Price April 21, 1952	Week's Rise or Fall	Est. Yield p.c.
Equipment and Manufacturing (continued)			£ s d		
Lancashire Dynamo	22½	12½*	43/3	—	5 15 6
Laurence,Scott(5/-)	12½	12½	10/6	—	5 19 0
London Elec. Wire	10	10	38/9	+1/6	5 3 3
J. Lucas	17½	7½*	31/3	—	4 16 0
Mather & Platt ..	12½	12½	43/3	−6d	5 15 9
Metal Industries ..	10	10	36/6	—	5 9 7
Mid. Elec. Mfg. ..	15	15	56/3	—	5 6 9
Murex	10	12½	48/-	+6d	5 4 3
Newman Ind. (2/-)	10	10	2/9	—	7 5 6
Oldham & Son (1/-)	30	30	4/3	—	7 1 3
Parsons, C. A. ..	15	10*	46/3	+1/6	4 9 0*
Plessey (5/-) ..	20	22½	16/3	—	6 18 6
Pye Deferred (5/-)	35	18*	17/-	—	5 6 0
Revo (10/-) ..	27½	27½	33/9	+1/6	8 3 0
Reyrolle	15	10*	43/-	—	4 13 0*
Scot. Cable (4/-) ..	30	30	20/3	—	5 18 5
Siemens Ord. ..	7½	10	35/-	—	5 13 8
Switchgear & Cowans (5/-)	22½	22½	13/9	+9d	8 3 9
T.C.C. (10/-) ..	15	20	45/-	—	4 9 0
T.C. & M. ..	10	10	34/6	—	5 16 0
TelephoneMfg.(5/-)	10	10	7/9	+3d	6 9 0
Thorn Elec. (5/-)..	20	10*	8/3	—	6 1 3
Tube Investments	25	25	5⅞	+1/6	4 10 0
Vactric (5/-) ..	Nil	Nil	5/9	—	Nil
Veritys (5/-) ..	2½	Nil	3/6	—	Nil
Walsall Conduits (4/-)	70	70	47/6	+6d	5 18 0
Ward & Goldstone (5/-)	44	45e	36/3	—	6 0 0
Watford (2/-) ..	20	25	5/9	—	8 14 0
Westinghouse Brake	14	14	47/6	—	5 18 0
West, Allen (5/-)..	10	12½	10/3	+3d	6 2 0
Transport and Communications					
Anglo-Am. Tel.:					
A Ord.	—	—	87½	+1½	—
Ord.	—	—	58	—	—
Anglo-Portuguese	8	8	21/3	—	7 10 7
Brit. Elec. Traction: Def. Ord. ..	22½	25	425	+10	5 17 8
Cable & Wireless:					
Ord.	6	8	110½	—	7 4 10
4% Loan ..	4	4	96½	—	4 1 3
Calcutta Trams ..	6†	6†	22/-	—	5 9 1†
Cape Elec. Trams	4	5	12/6	—	8 0 0
Globe Tel. & Tel. Ord.	—	—	23/6	—	—
Inter. Tel. & Tel...	Nil	15cts	33½	−½	—
Marconi Marine ..	7½	10	27/6	—	7 5 6
Oriental Tel. Ord.	16	16	55/-	+⅛	—
Telephone Props.	7	8	28/9	—	5 11 4
Tele. Rentals (5/-)	10	10	7/9	+3d	6 9 0

* After capital bonus.
† Dividends are paid free of Income Tax.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

Lightweight Iron

CLAIMING that excessive weight in an iron is not only unnecessary but a serious drawback to efficient ironing and that what really matters is a correctly heated soleplate the temperature of which can be constantly maintained or adjusted at will, MORPHY-RICHARDS, LTD., 121, Victoria Street, London, S.W.1, have brought out the new "Atlantic" model weighing only 2¾ lb.

The new "crossbow" thermostat eliminates radio interference and the long life element is completely embedded and built in the soleplate. The pilot light and flex entry is interchangeable for left- or right-handed users and an easy-grip handle is scientifically designed to fit the hand and is ventilated to ensure maximum coolness and comfort. The price is 45s for the a.c. model and 50s for the universal model. Though originally designed for the American continent, the new model will soon be available in this country.

Hair Dryer

The "Alenco" hair dryer manufactured by the OVERSEAS ENGINEERING CO., LTD., 194–200, Bishopsgate, London, E.C.2, is operated off the blowing end of any vacuum cleaner, hot or cold air being obtained as desired by push-button control. The price is 23s 8d (plus 5s 11d purchase tax in the United Kingdom).

Foot-operated Controller

A carbon type foot-operated speed controller for use in conjunction with fractional h.p. motors has just been brought out by HILLMAN ELECTRIC MOTORS, LTD., 2–3, Northwold Buildings, Northwold Road, London, N.16. The unit has a resistance variation from zero to 1,000 ohms and is capable of carrying up to 0·7 A. Models are available for use on all mains voltages between 100 and 250 V.

Industrial Immersion Heaters

"Chromeray" industrial heaters are now being supplied by SARUM ELECTRIC, LTD., 68, Brown Street, Salisbury, with two types of protective cut-out. Model IWRAR, which employs a vapour pressure operated switch, is especially suitable for sterilizers, kitchen equipment or any application in which the vessel

"Chromeray" model IWRAR immersion heater

may be frequently boiled dry or switched on without water. In this unit the elements are disconnected from the supply, and held off by a relay or latch mechanism until the main supply circuit is broken, thus preventing both waste of electricity and strain on the elements inherent with the cyclic re-setting switch.

No manual re-set knob is necessary and the

1. Hillman f.h.p. motor speed controller. 2. Morphy-Richards "Atlantic" iron. 3. "Alenco" hair dryer

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cut-out is sealed off. The switch has no mechanical parts liable to become distorted or jammed and is entirely independent of the position or alignment of the heating blades. The heaters can be supplied for operation under steam pressure and for special applications, with loadings from 1 kW on 2½in b.s.p.t. boss.

Model IWRAT, in which low water protection is provided by a removable thermostat unit, has been developed for applications in which it is an advantage to be able to control the water temperature up to boiling point. The cut-out action is automatic and re-sets when the blade temperature falls below the dial setting. The heaters have loadings from 1 to 4 kW.

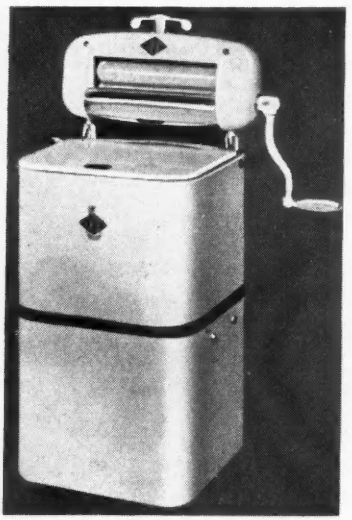
In both cases the models can be supplied with many terminal arrangements, with flameproof covers, three-heat control switch boxes or with flange fittings for high loadings.

Ceramic Switches

A. B. METAL PRODUCTS, LTD., 16, Berkeley Street, London, W.1, announce that their "H" type range of switches is now available with ceramic insulation.

Washer for Export

Special features of the "Cobra Junior" washing machine (export only) are soap economy, low electricity consumption, convenient dimensions for storage under the draining board, and a smoothly contoured interior and agitator mechanism ensuring safe washing of the flimsiest fabrics. The motor is particularly robust and the use of diecast alloy for all working parts gives complete freedom from rust. The "Cobra" machine, which is designed for use on all normal a.c. voltages, is made by the OSBORN MANUFACTURING CO., LTD., Highgate Square, Birmingham, 12.



"Cobra Junior" washing machine

Improved Sheep Shearing Machines

The Wolseley dual-purpose sheep shearing and cattle clipping machines made by the WOLSELEY SHEEP SHEARING MACHINE CO., LTD., Wolseley Works, Electric Avenue, Birmingham, 6, are now being equipped with a new special "Ringer" shear head similar to those previously supplied for overseas markets.

NEXT WEEK'S EVENTS

Monday, 28th April

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Radio Group. "Radar Sonde," by Dr. F. E. Jones.

KINGSBURY.—Prince of Wales Hotel, Kingsbury Road, N.W.9, 7.45 p.m. A.S.E.E. North-West London Branch. "Brains Trust."

LEEDS.—Lighting Service Bureau, 24, Aire Street, 7 p.m. I.E.S. Leeds Centre. Annual general meeting, followed by an address by the vice-president.

Monday, 28th April, to Saturday, 3rd May

LONDON.—Savoy Place, W.C.2. I.E.E. Radio Section. Convention on "The British Contribution to Television." Luncheon on Monday at 12.30 p.m. at the Connaught Rooms, W.C.2.

Tuesday, 29th April

LONDON.—21, Bloomsbury Street, W.C.1. Society of Relay Engineers. 11.30 a.m.—Annual general meeting. 2.30 p.m.—"Cables for Television Relay Systems," by J. D. S. Hinchliffe.

At the Royal Society of Tropical Medicine and Hygiene, Manson House, Portland Place, W.1, 7 p.m. Society of Instrument Technology. "Why the Human Operator?" by Dr. W. E. Hick.

Tuesday, 29th April, to Thursday, 1st May

TORQUAY.—Palace Hotel. Public Transport Association. Annual conference.

Wednesday, 30th April

LONDON.—I.E.E. London Students' Section, 2 p.m. Visit to Kodak, Ltd., Wealdstone, Harrow.

Friday, 2nd May

LIVERPOOL.—At the Liverpool Engineering Society, 9, The Temple, 24, Dale Street, 8 p.m. A.S.E.E. Liverpool Branch. Lecturettes.

NOTTINGHAM.—Electricity Showrooms, Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch. Electrical films.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 4th June from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1948

10[illegible]2. Eaton Manufacturing Co.—Control of electric motor driven mechanism. 16th July, 1948. Addition to 6556[illegible]. (673466.)

25[illegible]20. British Thomson-Houston Co., Ltd. (General Electric Co.).—Photo-electric cell structures. 24th September, 1948. (673361.)

1949

10041. General Electric Co., Ltd., Goodings, D. B., and Milner, M.—Electric contacts. 5th April, 1950. (673056.)

10184. Philips Electrical, Ltd.—Methods of electric arc welding. 14th April, 1949. (673077.)

10927. Radio Corporation of America.—Stabilization of microwave oscillators. 25th April, 1949. (673365.)

11810. Radio-Industrie Soc. Anon.—Scanning devices for television transmitters. 3rd May, 1949. (673368.)

14935. Westinghouse Electric International Co.—Systems for maintaining a tuned circuit at resonance. 3rd June, 1949. (673376.)

15429. Bradbury, G. H.—Radio aerials. 9th June, 1950. (673084.)

17535. General Motors Corporation.—Control device for electric motors. 2nd July, 1949. (673473.)

18417. Electric Construction Co., Ltd., and Milne, J. C.—Electrical control systems. 6th July, 1950. Cognate application 32989, 23rd December, 1949. (673089.)

19255. General Electric Co., Ltd., and Hewitt, W. H. L.—Locating devices. 18th July, 1950. (673092.)

19987. British Thomson-Houston Co., Ltd.—Automatic electric circuit opening devices. 29th July, 1949. (673474.)

20447. Sandor, F. M. A. (legal representative of Sandor, N., deceased).—Portable electric heaters. 6th November, 1950. (673097.)*

22598. Smith & Sons (England), Ltd., S., and Furzehill Laboratories, Ltd.—Safety devices for electric automatic control systems. 28th November, 1950. (673379.)

22620. Metropolitan-Vickers Electrical Co., Ltd.—Process timing and like devices. 15th August, 1950. (673102.)

22814. British Thomson-Houston Co., Ltd.—Methods of and apparatus for bending and exhausting tubular lamps. 2nd September, 1949. (673104.)

23520. Telefonaktiebolaget L. M. Ericsson.—Centralized street signalling system. 12th September, 1949. (673106.)

24266. British Thomson-Houston Co., Ltd.—Belt removing tools for vacuum cleaners. 21st September, 1949. (673109.)

25603. British Thomson-Houston Co., Ltd.—Electronic speed control systems for series motors. 5th October, 1949. (673114.)

25852. Marconi Instruments, Ltd.—Electrically operating moisture meters. 11th May, 1950. (673115.)

28295. British Thomson-Houston Co., Ltd.—Resistance winding machines. 4th November, 1949. (673123.)

29940. Amplivox, Ltd., and Assenheim, J. P.—Telephone receivers. 22nd November, 1949. (673128.)

32010. Glinka, C.—Thermal power plant. 3rd January, 1950. (673138.)

33273. Soc. d'Etudes de Machines Thermiques.—Power plants. 29th December, 1949. (673167.)

1950

532. Automatic Electric Laboratories, Inc.—Selective signalling system. 9th January, 1950. (673173.)

633. British Thomson-Houston Co., Ltd.—Electric motor control systems. 10th January, 1950. (673177.)

1853. Philips Electrical Industries, Ltd.—Radio receiving circuits. 24th January, 1950. (673387.)

1876. General Electric Co., Ltd., and Dudley, M. D.—Manufacture of cathode assemblies for electric discharge devices, especially cathode-ray tubes. 15th December, 1950. (673191.)

2360. Aircraft-Marine Products, Inc.—Crimped electrical connections and methods and tools for making them. 30th January, 1950. (673198.)

2832. Lorenz Akt.-Ges., C.—Scanning system for colour television. 3rd February, 1950. (673202.)

3019. Soc. Visodion.—Electric multi-contact switches. 6th February, 1950. (673390.)

3141. British Thomson-Houston Co., Ltd.—Grounding reactors. 7th February, 1950. (673206.)

3621. British Thomson-Houston Co., Ltd., and Appleyard, A. N.—Laminated magnetic cores having cooling means. 13th February, 1950. (673210.)

3991. Westinghouse Electric International Co.—Insulated electric coils. 16th February, 1950. (673214.)

4324. Wingfoot Corporation.—Electrically conducting rubber heating element. 20th February, 1950. (673218.)

4688. Radio Corporation of America.—Photo-sensitive cathode films. 23rd February, 1950. (673224.)

5303. Philips Electrical Industries, Ltd.—Electric lamps of the photographic flash-light type. 2nd March, 1950. (673406.)

6031. General Motors Corporation.—Electrical discharge systems. 10th March, 1950. (673410.)

6077/8. Hazeltine Corporation.—Tuning indicator systems for frequency modulation receivers. 10th March, 1950. (673141/2.)

6135. Sylvania Electric Products, Inc.—Filament mounting apparatus for electric lamps and similar devices. 10th March, 1950. (673144.)

6289. Maupas, C. F. E.—Sealing device for mineral-insulated sheathed electric cables. 13th March, 1950. (673235.)

6551. Sylvania Electric Products, Inc.—Oxide-coated cathodes. 15th March, 1950. (673237.)

7424. Philips Electrical Industries, Ltd.—Methods of tracing leaks in vacuum vessels and in devices therefor. 24th March, 1950. (673424.)

7953. Allmanna Svenska Elektriska Aktiebolaget.—Electric eddy current furnaces. 30th March, 1950. (673241.)

8140. Costello-Mausure, Inc.—Electrically heated vaporizers. 31st March, 1950. (673429.)

8285. British Thomson-Houston Co., Ltd.—Terminal structures for electric heating appliances. 3rd April, 1950. (673430.)

8752. Metropolitan-Vickers Electrical Co., Ltd.—Electromagnetic waveguides. 6th April, 1950. (673149.)

9001. Telefonbau und Normalzeit Ges.—Arrangements for private branch telephone exchanges. 12th April, 1950. (673249.)

9129. Egyesult Izzolampa es Villamos-Sagi, R. T.—Oxide cathode and process for the production thereof. 13th April, 1950. (673438.)

9464. Westinghouse Electric International Co.—Electric discharge lamps. 18th April, 1950. (673477.)

9706. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Target electrodes for the storage of electrical signals. 20th April, 1950. (673254.)

10036. British Thomson-Houston Co., Ltd.—Methods of ultrasonic investigation with wide-band frequency modulated waves. 21st April, 1950. (673447.)

10193. Marconi's Wireless Telegraph Co., Ltd.—Apparatus for reproducing from gramophone record discs. 13th December, 1950. (673450.)

10525. Radio Corporation of America.—Signal amplitude control systems employing semi-conductor devices. 28th April, 1950. (673258.)

10653. Electrolux Corporation.—High speed electrically driven centrifuge. 1st May, 1950. (673482.)

10946. Bendix Aviation Corporation.—Sensing device for telemetering. 3rd May, 1950. (673260.)

11242. Lumalampan Aktiebolag.—Electric incandescent lamps. 5th May, 1950. (673487.)

11644. British Thomson-Houston Co., Ltd.—Regulating systems. 10th May, 1950. (673490.)

12044. Standard Telephones & Cables, Ltd.—Frequency changing modulator or mixer circuits for high frequency signalling systems. 15th May, 1950. (673263.)

12051. Philips Electrical Industries, Ltd.—Contact rings for circular electrode supply conductors. 15th May, 1950. (673264.)

12089. Soc. Anon. Dite, Etablissments E. Belin.—Electronic high precision dial gauge. 15th May, 1950. (673495.)

12164. Allmanna Svenska Elektriska Aktiebolaget.—Metallurgical furnaces comprising stirring windings. 16th May, 1950. (673265.)

12204. British Thomson-Houston Co., Ltd.—Hall effect commutating apparatus. 16th May, 1950. (673496.)

12221. Lumalampan Aktiebolag.—Lampholder for Christmas tree illumination. 16th May, 1950. (673497.)

12314. Standard Telephones & Cables, Ltd.—Magnetic cores for electric induction apparatus. 17th May, 1950. (673267.)

12579. Standard Telephones & Cables, Ltd.—Cathode ray storage tube systems. 19th May, 1950. (673502.)

12716. Westinghouse Electric International Co.—Motor control systems. 22nd May, 1950. (673271.)

12924. Telefonaktiebolaget L. M. Ericsson.—Vehicle detector. 23rd May, 1950. (673505.)

12932. Radio Corporation of America.—Power recovery cathode-ray beam deflection systems. 23rd May, 1950. (673506.)

13266. Westinghouse Electric International Co.—Electronic frequency converting apparatus, particularly for resistance welding. 25th May, 1950. (673510.)

13573. Ateliers de Constructions Electriques de Charleroi.—Teleprinter communication systems. 31st May, 1950. (673515.)

14334. Metropolitan-Vickers Electrical Co., Ltd.—Centrifugal pumps and liquid seals supplied thereby. 8th June, 1950. (673520.)

15145. Sylvania Electric Products, Inc.—Electric gaseous discharge device electrode. 16th June, 1950. (673285.)

15842. General Motors Corporation.—Control device for electric motors. 26th June, 1950. Addition to 673473. (673522.)

16783. Philips Electrical Industries, Ltd.—Multiple switches for establishing a number of simultaneous connections between two groups of conductor systems. 5th July, 1950. (673295.)

16808. Hoover, Ltd.—Suction cleaners. 5th July, 1950. Addition to 608238. (673158.)

17212. British Thomson-Houston Co., Ltd.—Electric current rectifiers. 10th June, 1950. (673298.)

18065. Naamlooze Vennootschap de Butaafsche Petroleum Maatschappij.—Apparatus for electrically heating a gas and the use thereof in the carrying out of gas reactions. 19th July, 1950. (673305.)

18880. Forges et Ateliers de Constructions Electriques de Jeumont.—Air-blast electric circuit-breakers with switching resistances. 28th July, 1950. (673312.)

19529. Philips Electrical Industries, Ltd.—Circuit arrangements for frequency transformation of high-frequency oscillations. 4th August, 1950. (673314.)

19543. Westinghouse Electric International Co.—High-frequency heating apparatus and methods. 4th August, 1950. (673316.)

20434. British Thomson-Houston Co., Ltd.—Refrigerators. 17th August, 1950. (673324.)

21416. Compagnie Industrielle des Téléphones.—Ringing and regulating device in carrier current transmission systems. 30th August, 1950. (673329.)

23872. Westinghouse Electric International Co.—Production of consolidated insulation on electric coils. 29th September, 1950. (673335.)

25481. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Electron-discharge tubes for storing electrical signals. 19th October, 1950. (673342.)

26532. Research Corporation.—Device for rectifying alternating current. 31st October, 1950. (673343.)

26851. Kronprinz Akt.-Ges. für Metallindustrie.—Electric transformers. 3rd November, 1950. (673345.)

27436. Hoover, Ltd.—Suction cleaners. 9th November, 1950. (673348.)

27926. Western Electric Co., Inc.—Electron-emissive bodies, especially cold cathodes, and methods for their preparation. 15th November, 1950. (673458.)

29464. Standard Telephones & Cables, Ltd.—Electric signal communication systems. 1st December, 1950. (673354.)

29465. Standard Telephones & Cables, Ltd.—Receivers of electric signal communication systems. 1st December, 1950. (673355.)

29466. Standard Telephones & Cables, Ltd.—Receivers for pulsed frequency modulation carrier systems. 1st December, 1950. (673356.)

30985. Erie Resistor Corporation.—Variable condenser. 20th December, 1950. (673460.)

31025. Standard Telephones & Cables, Ltd.—Electric code modulation systems. 20th December, 1950. (673360.)

1951

24089. Westinghouse Electric International Co.—Electric discharge lamps. 18th April, 1950. Divided out of 673477. (673485.)

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CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—BRISBANE.—11th June. State Electricity Commission of Queensland. Two 66/12 kV step down transformers for the Capricornia Regional Electricity Board. (C.R.E. 1327/52. Ten/3834.)*

Belfast.—6th June. Electricity Department. Supply of 33 kV and low voltage cables for Victoria power station. (See this issue.)

East Kesteven.—17th May. R.D.C. Two electrically driven borehole pumps, complete with switchgear, cabling, equipment, etc. Howard Humphreys & Sons, engineers, 191, Victoria Street, London, S.W.1.

Halifax.—10th May. Education Committee. Renewal of the electrical installation at the Queens Road Junior School. (See this issue.)

India.—NEW DELHI.—22nd May. Directorate General of Supplies and Disposals. Supply of telephone cables. (C.R.E. 13586/52. Ten/3851.)*

Maidstone.—30th April. Borough Council. Electrical installations in 108 houses on Shepway estate. Borough surveyor.

Newmarket.—4th June. U.D.C. Street lighting equipment. (See this issue.)

Portuguese West Africa.—LUANDA.—15th May. Electric Light and Water Works. Supply of armoured cable and accessories. (C.R.E. 12544/52. Ten/3845.)*

South Africa.—BLOEMFONTEIN.—30th April. Town Council. Supply of 2,500 house service meters. (C.R.E. 13554/52. Ten/3838.)*

JOHANNESBURG.—6th May. Stores and Buying Branch, City Treasurer's Department. Supply of 20 kV cable. (C.R.E. 13899/52. Ten/3858.)*

Uruguay.—MONTEVIDEO.—12th May. Usinas Electricas y Telefonos. Eight transformer substations. (C.R.E. 12612/52. Ten/3839.)*

West Riding.—12th May. County Health Committee. Renewal of electrical installation at Thornton View, Cayton, Bradford. (See this issue.)

ORDERS PLACED

Birkenhead.—Education Committee. Electrical services at Birkenhead Technical College (£33,503).—Grierson, Ltd.

Bishop Auckland.—U.D.C. Erection and servicing of 24 street lamps at Cockton Hill (£2,017).—North Eastern Electricity Board.

Doncaster.—Corporation. Electrical installations in 54 houses on Cantley estate (£1,577).—Francis Sinclair, Ltd.

London.—POPLAR.—Borough Council. Recommended. Electrical installations and fittings in connection with the erection of Block "A" flats in the Teviott Street area (£4,082).—Holiday, Hall & Stinson, Ltd.

Newcastle-on-Tyne.—Regional Hospital Board. Electrical work at Block "A" of West Hartlepool General Hospital (£3,150).—Veale Nixon & Co., Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Basildon.—Works, Nevendon, for Rotary Hoes, Ltd., Brentwood; Hosking & Sons (Essex), Ltd., builders, Arterial Road, Rayleigh.

Bebington.—Houses (62), Glenburn Avenue, Eastham; borough surveyor, Brackenwood, Higher Bebington, Wirral.

Beddington (Surrey).—Flats (18), Beddington Corner; Pite, Son & Fairweather, architects, 5, Queen Anne's Gate, S.W.1.

Bedford.—First stage of North Bedfordshire College of Further Education; S. V. Goodman, county architect, Bedford.

Bedfordshire.—Kitchens and dining halls at Priory Street Schools, Bedford, and County Primary School, Arlesey; county architect, Shire Hall, Bedford.

Bedwas and Machen.—Houses (49), on site at Chatham; J. H. Thraves, architect to U.D.C., 63, High Street, Newport, Mon.

Beeston.—Junior girls' school, Roundhill, for Notts E.C.; Hofton & Son, Ltd., builders, Regent Street, Beeston.

Bexhill-on-Sea.—Convalescent home (£100,000) for Hearts of Oak Benefit Society; F. J. Daly, architect, 44, Blackfriars Road, London, S.E.1.

Billingham-on-Tees.—Houses on Northfield Road estate for Church Commissioners; Smith, Gore & Co., agents, Houndgate, Darlington.

Birmingham.—**Reconstruction of factory;** Harvo, Ltd., food specialists, 257, Lawley Street, Birmingham, 4.

Erection of Bartley Green Secondary Modern Mixed School; Thos. Lowe & Sons, Ltd., Grenville Buildings, Cherry Street, Birmingham.

Factory, Barford Street, for P. & M. Jig & Tool Co., Ltd.; C. Whitwell & Son, architects, 3, Newhall Street, Birmingham.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

Bradfield.—Houses at Calcot (34) and Bucklebury (16) for R.D.C.; A. Blake & Sons, builders, Padworth, near Reading.

Carlisle.—Ward block at the City General Hospital for Regional Hospital Board; N. Edgarm, divisional architect, 1, Lonsdale Street, Carlisle.

Colchester. — Dwellings (81), Monkwick estate; J. S. Orchard, borough surveyor, Town Hall.

Consett.—Houses (31), Moorside; C.T.C. (Builders), Ltd., Queens Road, Blackhill.

Crawley.—Factory and offices; W. Edwards (London), Ltd., Worsley Bridge Road, S.E.26.

Croydon.—Reconstruction of Surrey Street waterworks pumping station (£31,875); borough water engineer.

Additional accommodation at Lanfranc Secondary Boys' School (£35,000); C. T. Ayerst, architect, 38, High Street.

Doncaster.—Boys' modern school, Wheatley (£135,640); town clerk, 1, Priory Place.

Dudley.—Houses (220), Sledmere estate; Webb & Gray, architects, St. James' Road.

Edmonton.—New buildings for North Middlesex Hospital; North East Metropolitan Regional Hospital Board, 11, Portland Place, W.1.

Enfield. — Reconstruction and extensions, County Grammar School; county architect, 10, Great George Street, S.W.1.

Gainsborough.—Modified scheme for restoration and improvements at Town Hall (£17,000); U.D.C. architect.

Gateshead.—R.C. church, Mill Way; R. Burke, 10, Lambton Road, Newcastle.

Adaptations at Bensham Hospital (£10,000); borough architect.

Glasgow.—Houses (150), Braehead, Cathcart; MacTaggart & Mickel, Ltd., 107, West Regent Street.

Gorleston.—Peterhouse school (£60,453) for Great Yarmouth E.C.; H. A. Holmes & Sons, builders, Bath Hill Terrace, Great Yarmouth.

Halifax. — Crematorium, Park Wood (£73,000); borough surveyor, Crossley Street.

Haverfordwest.—Fire station and brigade headquarters (£40,000), for Pembrokeshire C.C.; county architect, Haverfordwest.

Hayes and Harlington.—Dwellings (96), Barnhill estate; A. E. Higgins, clerk, Town Hall, Hayes.

Leek.—Houses (30), Brown Edge; M. Daniels, clerk to R.D.C., 6, Russell Street.

Lindsey.—Primary and secondary modern schools (Gainsborough, Scunthorpe and Cleethorpes) for C.C.; county architect, County Offices, Lincoln.

First instalment of secondary modern school, Coningsby/Tattersall; J. T. Barber & Son, Boston.

Liverpool.—Houses (1,000), Kirkby estate; city architect.

London.—St. Johns Wood.—Flats (120), Wellington Road, for St. Marylebone B.C.; T. P. Bennett & Son, architects, 43, Bloomsbury Square, W.C.1.

Stoke Newington.—Flats (30), Seven Sisters Road; Howes & Jackman, architects, 1, Verulam Buildings, Gray's Inn, W.C.1.

Manchester.—Departmental store and offices, St. Mary's Gate; F. W. Woolworth & Co., Ltd., 1, New Bond Street, W.1.

March.—Bungalows (54) and flats (20); U.D.C. architect, March, Cambs.

Newcastle-on-Tyne. — Multi-storey flats (1,000), Longbenton, for City Council; Sir R. McAlpine & Sons, Ltd., builders, Star Buildings, Newcastle.

Residential hostel, Elmfield Road (£13,800); R. Bowey & Son, Ltd., builders, Back Ruby Street, Newcastle.

Special boarding school, Jesmond Dene, for E.C.; city architect, 18, Cloth Market, Newcastle.

Penrith.—Improvements to Penrith Cottage Hospital; Airey & Lewis, builders, Penrith.

Perivale.—Works extensions for Hoover, Ltd.; Haymills, Ltd., builders, Hanger Green, W.5.

Peterborough.—Four-class school, Wittering (£25,520); Joint Education Board's architect, Peterborough.

Peterlee (Co. Durham).—Houses (112) for Peterlee Development Corporation; G. M. Pearson & Son, builders, Hetton, Co. Durham.

Poulton-le-Fylde.—Houses (84), Carr Head estate; U.D.C. surveyor, Church Street.

Reading. — Waterworks depot, Berkeley Avenue (£50,000); H. A. Sandford, electrical consultant, 2, Gate Street, W.C.2.

Rothwell.—Flats (32), Lawrence Villa site, Woodlesford (£38,124); Middleton & Co., builders, Blackpool.

Smethwick. — Works extensions; M.D.M., Ltd., Rolfe Street.

South Shields.—Houses (124), Auckland Avenue; William Leech, Ltd., builders, Clayton Street, Newcastle.

Spenborough.—Houses (88), Garden House, Littletown; U.D.C. surveyor, Cleckheaton.

Staines.—Works extensions; W. E. Sykes, Ltd., Manor Works.

Stone (Staffs).—Houses (72), Lichfield Road site, for U.D.C.; M. A. Boswell, Ltd., builders, School Street, Wolverhampton.

Swansea.—Reconstruction of Waterloo warehouse (£37,880); Morgan Jenkins & Son, The Pryn, Sketty Green.

Flats (56), Penlan; borough architect.

Tamworth.—Houses (100), Gilway estate; Drury & Co., Ltd., builders, Leicester.

Tynemouth.—Houses (60); borough engineer, 16, Northumberland Square, North Shields.

Wallington.—Rebuilding factory, Church Lane; Fell & Briant, Ltd., label printers, Wallington.

Wallsend.—Nurses' home; county architect, County Hall, Newcastle.

West Riding.—Additional classrooms at various schools; county architect, Wakefield.

Whitley Bay.—Housing scheme (246 houses), at Earsdon Grange; U.D.C. surveyor.

Wolverhampton.—Shopping centre on East Park estate, with block of two-storey houses, garages, etc.; town clerk, Town Hall.